



The Stars for Children

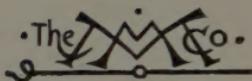
Gaylord Johnson



P.C.C. "26

PHILIP C. CURTIS, JR.

THE STARS FOR CHILDREN



THE MACMILLAN COMPANY
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TORONTO

THE STARS FOR CHILDREN

BY
GAYLORD JOHNSON

"Why did not somebody teach me the constellations, and
make me at home in the starry heavens, which are always
overhead and which I don't half know to this day?"

—*Thomas Carlyle.*

NEW YORK
THE MACMILLAN COMPANY
1934

THE STAR PEOPLE

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THE SKY MOVIES

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TWO VOLUMES IN ONE

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CONTENTS

PART I
THE STAR PEOPLE

PART II
THE SKY MOVIES

THE STAR PEOPLE

TO
BABY ANNE

WHAT HAPPENED IN STARLAND

	PAGE
FIRST EVENING—	
In which the Society of Star Gazers is formed and discovers Two Bears, one with a stretched tail.	1
SECOND EVENING—	
The Herdsman's Dogs chase Ursa Major and the terrible Dragon wriggles away in fright.	12
THIRD EVENING—	
Uncle Henry's magic turns the Lyre into a Ukelele, and the Archer's arrow misses the Swan and hits the Scorpion.	24
FOURTH EVENING—	
The Virgin is too busy feeding her Sky Poultry, so Cassiopeia gets the Ukelele to play.	31
FIFTH EVENING—	
In which a Dolphin with an ear for music saves a Poet's life—and Uncle Henry puts two birds in one poem.	41
FIRST WINTER EVENING—	
The "Society" learns why Orion needs a club to keep Frisky Taurus in order, and why we say "By Jimini!" when we're excited.	52
SECOND WINTER EVENING—	
In which the dogs of Orion and Gemini follow their masters, Pegasus escapes as usual, and Andromeda	

WHAT HAPPENED IN STARLAND

	PAGE
gets a nice soft bed of hay in place of her hard old rock.....	61
THIRD WINTER EVENING—	
The Sky clouded over, but Peter found the Star People hiding in the Almanac—Paul found that his head was the World—and the “Society” found out about the Swastika and the Zodiac, and how you tell when a Dipper is a Plough and when it’s a Wagon.....	78
FOURTH WINTER EVENING—	
In which the “Society” meets the last of the Star People and the beginning of Astronomy—and Betty proposes a “Note” of thanks.....	99

TO HELP YOU FIND THE STAR PEOPLE IN THE SKY

Whenever Uncle Henry draws a line to point out one of the star people you will find a figure, close to what he says, like this: (10).

Find the same figure on one of the maps inside the front or back cover, and you will see the line that Uncle Henry drew—and find the star person or animal easily in the sky.

Numbers 1 to 17 can be located on the front cover maps. Numbers 18 to 32 can be found on the maps inside the back cover.

To Use the Maps

Face South and hold the map for the proper season over your head—with the top of the book toward the West and the bottom toward the East. You will then see the Star People in the same places they appear in the sky.

The maps are drawn for 9 o'clock on April 1st, July 1st, October 1st, and January 1st, but they will be found serviceable in the preceding and following month. When necessary consult the maps for the season coming before or after.

WHERE TO FIND THE "PEOPLE" YOU WANT

<i>Names of Star People</i>	<i>How to Pronounce</i>	<i>Where to Look in the Book</i>	<i>Where to Look on the Maps</i>	<i>Where to Look on the Maps</i>
Andromeda.....	(an-drom'ē-dā)	Page 70	Number 25.....	Sept. to Feb.
Aquarius.....	(a-kwā'-ri-us)	" 50.....	" 19.....	" Aug.
Aquila.....	(ak'-wi-lā)	" 48.....	" 17.....	" Dec.
Aries.....	(a'-riēz)	" 75.....	" 44.....	" June " Nov.
Auriga.....	(ä-rī'gā)	" 105.....	" 44.....	" Sept. " Feb.
Boötes.....	(boō'-ōz)	" 16.....	" 32.....	" June " Oct.
Cancer.....	(kan'-ser)	" 73.....	" 2.....	" April " Oct.
Canes Venatici	(kā'-nez ve-nat'ī-cī)	" 17.....	" 27.....	" Jan. " June
Canis Major.....	(kā'-nis mā'-jor)	" 62.....	" 2.....	" Feb. " Sept.
Canis Minor.....	(kā'-nis mi'-nor)	" 72.....	" 22.....	" Jan. " April
Capricornus.....	(kap'-rikōr'-nūs)	" 44.....	" 44.....	" Dec. " May
Cassiopeia.....	(kās'-ē-pē'-yā)	" 49.....	" 44.....	" Aug. " Nov.
Cerberus.....	(see'-ber-ūs)	" 35.....	" 12.....	" Jan. " Dec.
Corona Borealis	(ko-ro'-nā bōr'-ē-ā'-līs)	" 38.....	" 14.....	" April " Nov.
Crater.....	(sig'-nūs)	" 33.....	" 11.....	" April " Oct.
Delphinus.....	(del'-fī-nūs)	" 21.....	" 4.....	" June " Dec.
Draco.....	(drā'-kō)	" 44.....	" 16.....	" June " Jan.
Gemini.....	(jēm'-ī-nī)	" 23.....	" 5.....	" Jan. " Dec.
Heracles.....	(her'-kī-lēz)	" 59.....	" 21.....	" Dec. " June
Leo.....	(lē'-ō)	" 38.....	" 14.....	" April " Nov.
Leo Minor.....	(lē'-ō mi'-nor)	" 20.....	" 3.....	" Feb. " July
Lepus.....	(lē'-ō-pūs)	" 20.....	" 3.....	" Jan. " July
Libra.....	(lī'-brā)	" 64.....	" 44.....	" Dec. " March
Lyra.....	(lī'-ra)	" 36.....	" 44.....	" May " Aug.
Ophiuchus.....	(of-i-ū'-kūs)	" 25.....	" 11.....	" April " Dec.
Orion.....	(ō-rī'-ōn)	" 42.....	" 15.....	" May " Oct.
Pegasus.....	(peg'-ā-gūs)	" 56.....	" 20.....	" April " Nov.
Perseus.....	(per'-sūs)	" 67.....	" 23.....	" Aug. " Sept.
Pisces.....	(pis'-ēz)	" 102.....	" 30.....	" Sept. " May
Sagitta.....	(sa-jīt'-ā)	" 76.....	" 14.....	" Sept. " Feb.
Sagittarius.....	(sa-jī-tā'-ri-us)	" 26.....	" 16.....	" June " Dec.
Scorpio.....	(skōr'-pī-ō)	" 27.....	" 7.....	" July " Sept.
Serpens.....	(ser'-pēns)	" 29.....	" 9.....	" June " Sept.
Taurus.....	(tā'-rūs)	" 42.....	" 16.....	" May " Oct.
Triangulum.....	(tri-ān'-gū-lūm)	" 58.....	" 20.....	" Nov. " April
Ursa Major.....	(er'-sā mā'-jor)	" 75.....	" 31.....	" Sept. " Feb.
Ursa Minor.....	(er'-sā mi'-nor)	" 7.....	" 1.....	" Jan. " Dec.
Virgo.....	(ver'-gō)	" 10.....	" 1.....	" Jan. " Dec.
		" 33.....	" 10.....	" April " Aug.

STAR PEOPLE ON MAPS BUT NOT TALKED ABOUT BY "THE SOCIETY"

(a) Hydra (hī'-dra)
(b) Crater (krā'-ter)

(c) Corvus (kōr'-vūs)
(d) Cepheus (sēf'-ūs)
(e) Cetus (sē'-tūs)
(f) Eridanus (ē-rid'-ā-nūs)

THE STAR PEOPLE

FIRST EVENING

IN WHICH THE SOCIETY OF STAR-GAZERS IS FORMED
AND DISCOVERS TWO BEARS—ONE WITH A
STRETCHED TAIL

UNCLE HENRY sat on the porch of “Seven Oaks” Cottage, watching the new moon sink into the woods across Sand Lake.

The ripples of the motor-boat that had carried “Sister” and “The Children’s Father” away from the dock had gone from the glassy water. Over across the lake, at Pentecost station, they would catch the ten o’clock train, to be gone a week.

Uncle Henry had urged “Sister” to go. He had said he was perfectly sure of being able to look after Peter and Paul and Betty for just seven days, but now that “Sister” was really gone Uncle Henry felt the size of the task he had undertaken.

Of course he wasn’t alone. There was big, wholesome Katy, the maid. “Competent Katy,” he had at once named her to himself on his arrival two weeks before. The sleeping, eating, and dressing of twin ten-year-old boys and a seven-year-old girl would go on as usual without Uncle Henry’s assistance.

In the daytime he planned to take them fishing, berry-picking, sailing, and bathing. Target-practice

with Peter and Paul's air-rifle would help, too, and there would be walks in the woods, and up to Brighton's farm house for the milk every evening.

But between supper and bed was a gap that Uncle Henry thought might be hard to fill. He must think of some games. He didn't want to be a poor companion for his adored niece and nephews for even an hour of the time.

Uncle Henry blew a cloud from his pipe and watched it eddy slowly away, filtering through the leaves of the oak-branches at the side of the porch. Then he looked up to the vaporous band of the milky way. Stars hung in it, sparkling. It was like a chiffon streamer with tiny diamond spangles—or a cloud of smoke, blown, with sparks, from the pipe of Pan.

You will see right away that Uncle Henry was a poet, even if Pan's pipe wasn't the smoking kind. It might have been, as easy as not. Uncle Henry was wondering whether this last fancy might be made into a poem for his college paper, when the children's voices floated up from the beach. They were sitting on the smooth sand and singing in unison.

“Star bright, star-light—
Many's the star I see tonight.
Star bright, star-light—
Tell me, is it true?”

I wish I may, I wish I might
Get the wish I wish tonight—
Star bright, star-light,
Tell me, is it true?”

Uncle Henry took his feet off the porch-railing and allowed his chair to use all of its feet again. Then he leaned out by a post and looked straight up into the blue-black vault of a moonless July night sky. The stars were beautifully clear.

Evidently Peter, Paul, and Betty were singing praise to the fact. They had clapped enthusiastically for themselves, and were now beginning the encore—a repetition of “Star bright, star-light.”

Uncle Henry’s face had become thoughtful, and now he stepped down from the porch, and strolled down the boards to the dock. There he stood craning his neck backward and looking up, until the children had once more finished the verse, laughing and clapping. Evidently the applause for themselves was not enough this time, for there was no encore.

Peter, his eye on Uncle Henry, flopped down on his back and began gazing upward, too. In a moment he called,

“Uncle Hen?”

“Yes, Pete,” from the dock, where Uncle Henry was star-gazing in the opposite direction.

“Why do they call ‘the big dipper’ the ‘great bear’—and *is* there any ‘little dipper’? Betty says there isn’t, ‘cause she never saw it.”

Uncle Henry stepped off the dock upon the smooth sand, kneeled down, and without answering began collecting little smooth pebbles.

Peter sat up and asked in surprise,

“Don’t *you* know, Uncle Hen?”

Surely this genius, who could make new kinds of

kites, and willow-whistles that "worked fine," was not going to fail now. The other children turned to him, expectant too. Betty herself was willing to be proved wrong about the existence of the "little dipper," rather than admit a limit to Uncle Henry's wisdom.

"Let's make a nice, smooth place on the sand," said Uncle Henry, his hands now full of those mysterious pebbles. These he put into his pocket and began, on all fours, to smooth sand industriously.

"Come on, youngsters," he invited, "and I'll let you settle the questions yourselves. We'll make a game of it," he added.

The trio breathed easier. Uncle Henry *did* know, and was going to tell—in a new, interesting way. Three pairs of hands started smoothing sand, with some waste of energy, but with rapid results.

"Now," said Uncle Henry, squatting down before the leveled place, and pouring out the pebbles in a little pile, "how many stones do you need to make the dipper, Pete? We'll draw it on the sand, with pebbles for stars."

Three necks craned upward in unison, and the two boys' voices answered, almost together,

"Seven."

Betty gazed a moment longer, and said,

"Eight."

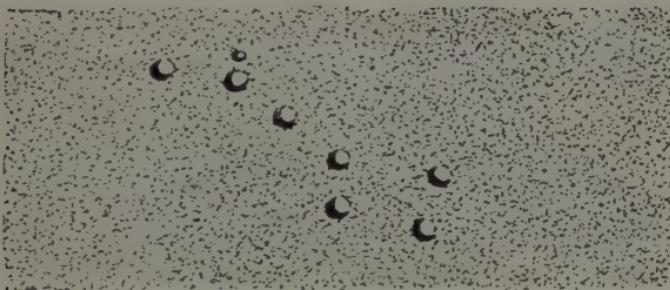
Uncle Henry looked interested.

"Where do you see the eighth, Betty?" he asked.

"Right close where the handle bends," announced Betty.

"Correct," said Uncle Henry, "that shows you have good eyes. The Arabs used to call that little star 'the proof,' because it is a test of good eyesight to see it. The star at the bend of the handle is also called 'the horse,' and that faint little star over it 'the rider.' You can make the dipper itself with seven pebbles, though. Go ahead and do it, Peter," Uncle Henry finished, "and take good-sized stones, to show that they're bright stars."

When Peter had finished, the smooth patch of sand looked like this in the light from Uncle Henry's pocket electric torch.

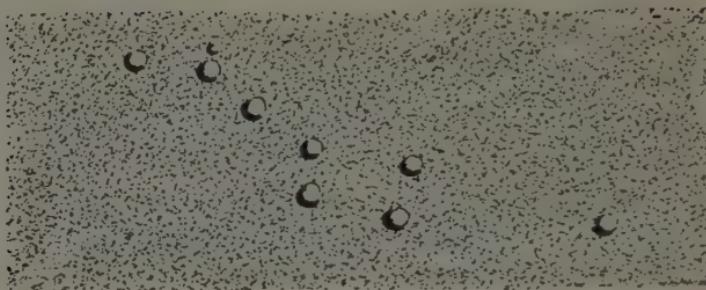


Betty insisted upon adding a tiny stone above "the horse," to represent her discovery, "the rider."

"Now," said Uncle Henry, looking upward, "I'll help you this much in finding all of 'the great bear.' The handle of the dipper is his tail. Everybody try to find the rest of him. Put down a pebble in the right spot for every star; big ones for bright ones, and little stones for faint ones."

"Ooh," interrupted Betty, "I got his nose!"

Here is where Betty put it.



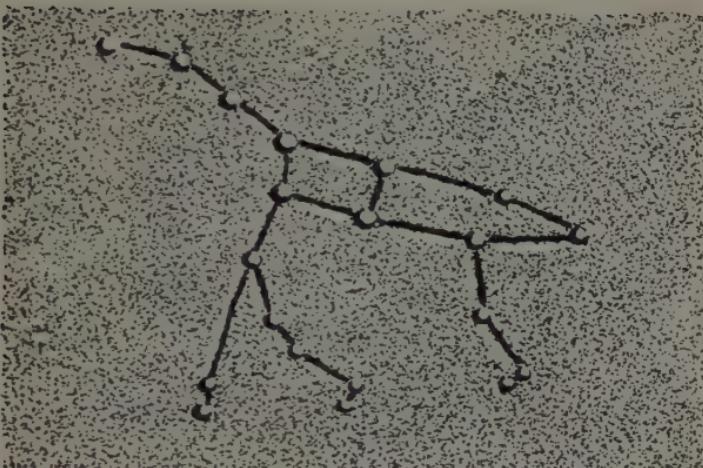
“—and his shoulders!” she added in a moment, putting them in with small pebbles.

“I got his front leg!” announced Paul excitedly, adding three pebbles rapidly.

Then the bear looked like this.



It was Peter who contributed his hind legs and his “skeleton,” made of finger-drawn lines in the sand. Like this.



And when Uncle Henry had drawn an outline in the sand with his finger, the "great bear" was done to everybody's satisfaction.



While they were all looking at it, Uncle Henry recited,

“*Ursa Major*’s Latin—
And it means, ‘the greater bear.’
Ursa’s ‘bear,’ and *Major*’s ‘bigger,’
If you want to see his ‘figger,’
At the dipper’s handle stare—
That’s the tail of *Ursa Major*.
Find his shoulders, nose, and toes—
Who first named him, no one knows.”

“Did you say, ‘Noah’—or ‘no one,’ Uncle Henry?” asked Betty.

“I said, ‘no one,’ but have it ‘Noah’ if you like,” said Uncle Henry. “Maybe Noah named him. He was interested in animals, and Adam ought not to have the only right to name them.”

“Now let’s find the little dipper!” urged Peter, anxious for a victory over Betty’s doubts of its existence.

“When we find it,” announced Uncle Henry solemnly, “it won’t be a dipper at all; it will be another bear—a little bear. You know that Noah had two of everything in his ark.”

“I told you there wasn’t any little dipper!” shrilled Betty at Peter.

“Uncle Henry said we’d find it, though,” countered Peter, looking hopefully at the oracle.

“So we will,” laughed Uncle Henry, “the little dipper and the little bear are the same thing!”

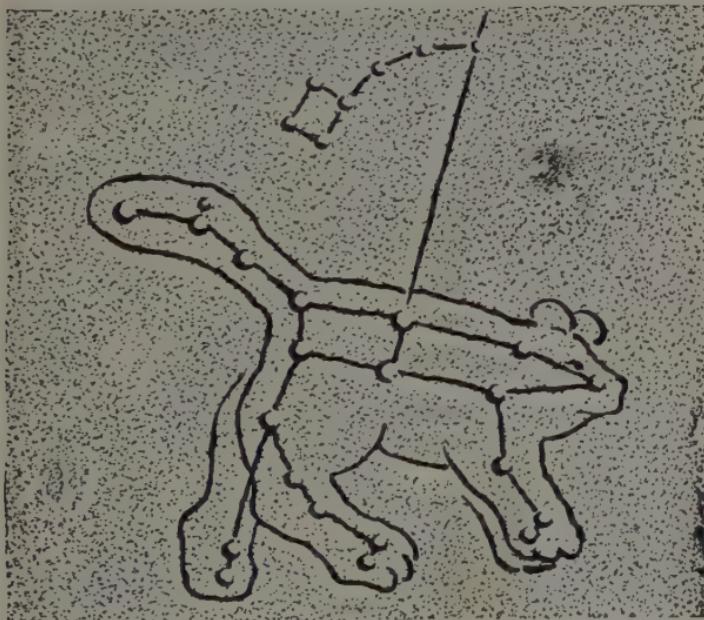
“Come on!” urged Paul, “how do we start, Uncle Henry?”

Uncle Henry got up on his knees and drew a long straight line in the sand with his forefinger. (1) It went up through both stars in the middle of the great bear's body, and a long way beyond. Over three times the distance between the two stars the line went beyond them. Uncle Henry put down a fair-sized pebble at the end.

"There," he said, "is the tip of the little bear's tail. Go ahead and find him; but I warn you—it's a very long tail, and you'll have to imagine his legs and nose."

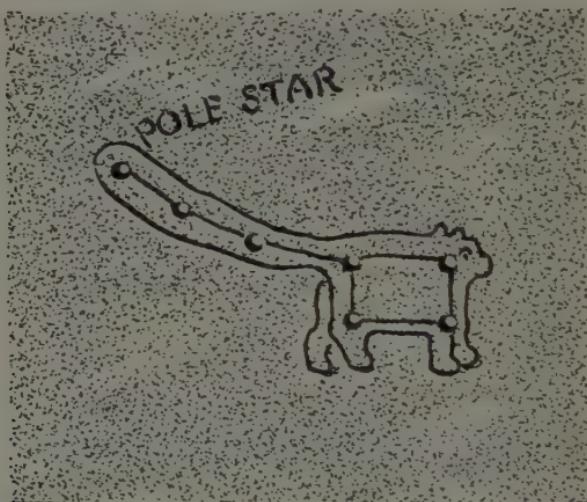
There was a moment's silence. Then Peter said, "I can't see any bear, but I *can* make out a dipper."

"Make it," said Uncle Henry.



When Peter finished putting down little pebbles the little dipper was very plain, just above the great bear's back.

Then Uncle Henry solemnly drew an outline around the seven small pebbles.



"Oooh, what a funny bear!" laughed Betty, when Uncle Henry's finger had finished. "His tail is so long!"

"Bears always have *short* tails," said Peter, looking reproachfully at Uncle Henry, as if that person was responsible. There was, however, a note of expectancy in Peter's voice. He expected a satisfactory explanation from Uncle Henry.

"This bear *once* had as short a tail as any other bear," said Uncle Henry, quite undisturbed.

"Who stretched it?" inquired Paul breathlessly.

"You will note," began Uncle Henry, "that the

tip of the little bear's tail is a star that is right at the top of the North Pole. You can't *see* the pole, but it's there—and long ago somebody tied the tip of the little bear's tail fast to it. As the earth turned around year after year, and the pole turned with it, the little bear was swung round and round by his tail. That would make anybody's tail stretch, wouldn't it?"

There was a moment's quiet. Then Peter said roguishly,

"You can't kid us into believing that, Uncle Hen—but we'll sure remember it."

All Uncle Henry said was,

"Your mother doesn't like you to talk slang, Peter."

Uncle Henry had scored again, and knew it.

"To-morrow night we'll find the dragon, and the man who drives the great bear around the pole, and his dogs, and maybe the lions and the swan," promised Uncle Henry, as he looked at his watch and stood up.

"Oooh, great!" cried the trio together.

"We'll have a reg'lar Noah's Ark on that sand, won't we?" said Betty.

"We'll call it 'Noah's Ark in the Sky,'" Uncle Henry agreed, as the children followed him up the walk to Seven Oaks Cottage.

SECOND EVENING

THE HERDSMAN'S DOGS CHASE URSA MAJOR—AND
THE TERRIBLE DRAGON WRIGGLES AWAY IN FRIGHT

THE next evening Peter, Paul, and Betty were all down on the beach as soon as supper was over.

Peter and Paul had that morning made a fence of laths around the sand drawings of the two bears—big, and little, so that “Rags,” their Airedale puppy, could not spoil them.

Now that “Rags” was asleep under the cottage, Peter and Paul removed the fence and smoothed the sand carefully for several yards around the bears, while Betty collected a quite unnecessarily large number of pebbles to represent the stars that would be found, with Uncle Henry’s help, when the twilight faded.

When all this was done the trio sat down beside the smoothed space and called to Uncle Henry, on the porch, that one star was already out and he had better hurry.

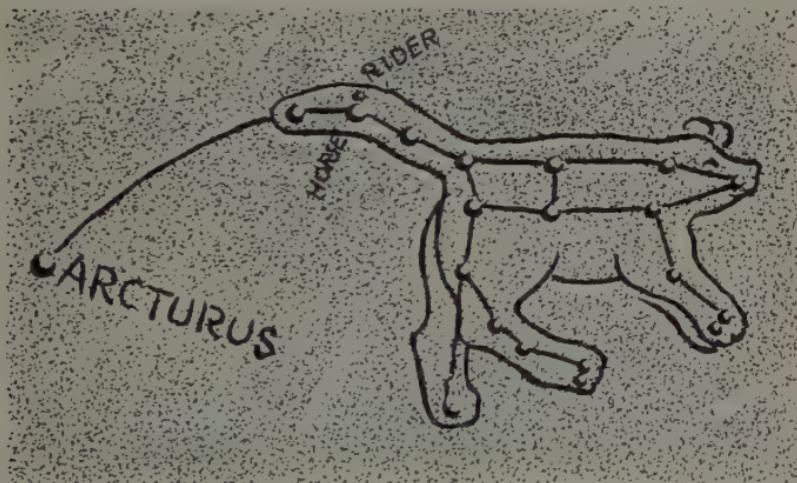
“I’ll come when you can see *Ursa Major’s* tail,” called back Uncle Henry, and the children had to wait, although they shrilly announced each new star that glowed into sight in the darkening sky, and repeatedly urged Uncle Henry to “come on and begin!”

The seven stars of the big dipper were all plainly

visible when Uncle Henry caine down the board walk and sat cross-legged on the sand.

The first thing he did was to extend the line joining the last two pebbles in the great bear's tail until it was about five times as long as before, and curved slightly downward as it went. (2)

"Now, Betty," he said, "give me a pebble—a good big one. This is a bright star we'll begin with; see if you can find it," and Uncle Henry put down the pebble at the end of the line, like this.



The three exclaimed, "I see it!" almost together.

"All right, then, we'll find 'Boötes,' the herdsman who drives *Ursa Major* round the pole," said Uncle Henry. "He has two dogs to help him besides. We'll find them too."

The children gazed upward for some time, intently silent.

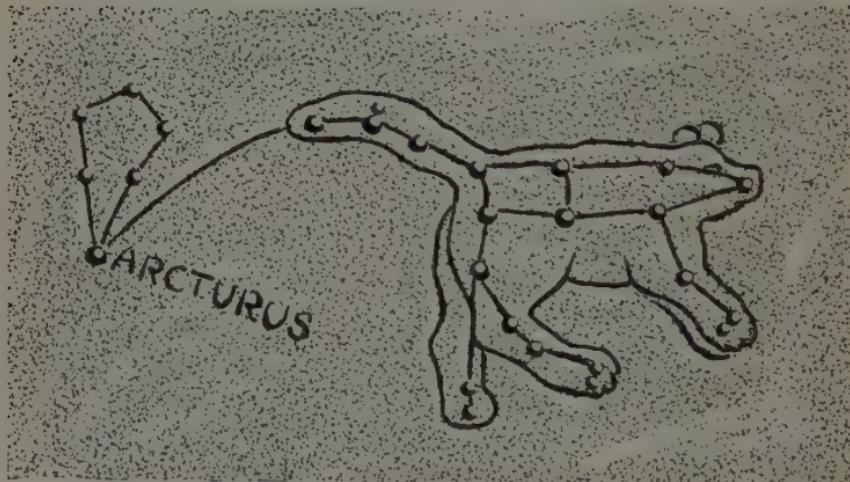
"I guess," observed Betty finally, "that you'll have to tell us whether that big star is the bear-driver's head—or one of his 'booties,' Uncle Henry."

A duet of groans from Peter and Paul followed this example of the lowest form of wit.

"I can't see anything that looks like a man the least bit," she went on, oblivious of the groans, "but I can see a kite, with that big star at the place where the tail would be fastened on."

"Fine," said Uncle Henry, "Make the kite then, Betty—and then we'll find the herdsman after we've flown the kite a while. That's the wonderful thing about Starland. If you get tired of one of the beasts or people in it—presto! You can change him into anything he looks like to you. *Boötes* is really much more like a kite than a man, so let's make the kite. Put the pebbles down, Betty."

Betty did, and they looked like this.



“That was easy!” exclaimed Peter.

“Never you mind, Mr. Peter!” Betty burst out warmly, “I found it first, anyhow!”

“We’ll let Peter find the bear-driver’s head,” said Uncle Henry judicially.

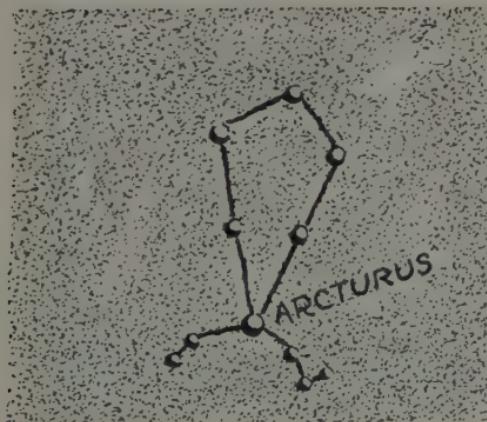
Peter promptly picked the big star at the tail-end of the kite.

“You’re wrong,” said Uncle Henry, “but I don’t blame you. *Arcturus* is much too bright and beautiful to be only a big, bright button on the lower edge of *Boötes*’ shepherd’s kilt—but that is all it is. The star at the top end of the kite is his head, and the two stars at the ends of the cross-stick of the kite are his shoulders. About halfway from them to *Arcturus* you can find the belt of his kilt, and——”

“Oh, I see his legs!” interrupted Paul. “He’s running after the big bear.”

“Put them in, Paul,” said Uncle Henry.

Paul did, and the figure of *Boötes* grew to look like this.



"But he hasn't any arms!" said Peter.

"Yes, he has," explained Uncle Henry, "his left one is up in the air, and his right one holds a shepherd's crook upon his right shoulder. Like this."

Uncle Henry added pebbles and lines until *Boötes* was finished.



"What awful short legs he has!" criticised Betty.

"That must be why he's never caught the great bear," smiled Uncle Henry.

"What's he shaking his fist for?" inquired Paul, pointing to the herdsman's left hand. "Is he so mad because he can't catch *Ursa Major*?"

Uncle Henry did not reply, but drew two long lines from the uplifted hand downward to a point just below the end of the big bear's tail.

"Oh, I know!" piped Betty, and throwing herself on her back, she began to star-gaze industriously.

Peter and Paul looked at each other inquiringly.

"The dogs!" said Peter. "Betty's looking for them. They're on leash of course. Those lines are the leashes."

Uncle Henry smiled his pleasure.

"The hunting dogs—or, as you would say it in Latin, *Canes Venatici*, are largely imaginary. There are six stars—three in each dog, and all faint except one, named *Cor Caroli*."

"I see the bright one!" said Peter, and put down a fair-sized pebble to represent it. When the children had found the five other faint stars and Uncle Henry had finished drawing the dogs, *Boötes* and his hunting hounds, *Asterion* and *Chara*, looked like this.



"Why do they call the bright star at the tail of *Chara, Cor Caroli*, Uncle Henry?" asked Paul.

"It is Latin for 'heart of Charles,'" said Uncle Henry, "and the Charles they mean is Charles the Second of England, but don't ask me why, for I don't know. Perhaps the dog *Chara* ran away with *Cor Caroli*. I understand that Charles the Second lost his heart pretty often, and perhaps one time he didn't get it back. Beware, Paul! I am Father William out of Alice in Wonderland; 'you have asked me three questions and that is enough.'"

"Are you going to make a poem for us to-night, too?" inquired Betty hopefully.

"Let me see," said Uncle Henry thoughtfully. "Great bear, *Boötes*, pronounced Bō-ō-tees, and two dogs—they ought to make some kind of a poem. How's this? I'll let you name it after you've heard it."

"The big bear runs, the herdsman runs,
His dogs, they both are chasing.

While *Ursa* growls, *Boötes* howls,
His dogs, they both are barking.

For *Ursa* stole *Boötes'* bowl
Of hot milk, set acooling.

His mouth burns yet, the bowl's upset,
The milky way is streaming."

"The milky way to catch a bear," suggested Paul, as a name for the poem.

“Who spilt the milk?” volunteered Peter.

“The herdsman hasn’t ever caught *Ursa Major*,” said Betty reflectively, “so he’s wasting his time chasing him. ‘Don’t cry over spilt milk’ would be a good title, I think. He ought to be tending his silly sheep, if he has any.”

“I’ve got it!” exclaimed Peter, ‘Ursa was a big bear; Ursa was a thief.’ Like ‘Taffy the Welshman,’ you know.”

Since no one else had a better title, the “Society of Star-Gazers,” as Paul had named it, let it go at that, and allowed Boötes to persist in his pursuit of the great bear for his ancient mischief.

“I thought you were going to show us the lions to-night, Uncle Hen,” said Peter.

“So I am, Peter,” said Uncle Henry. “Tell me what you see just below and between *Ursa Major’s* hind feet.”

All the children looked, and Peter answered,

“Three faint stars, like a triangle.”

“Put them in with pebbles,” said Uncle Henry, and Peter did.

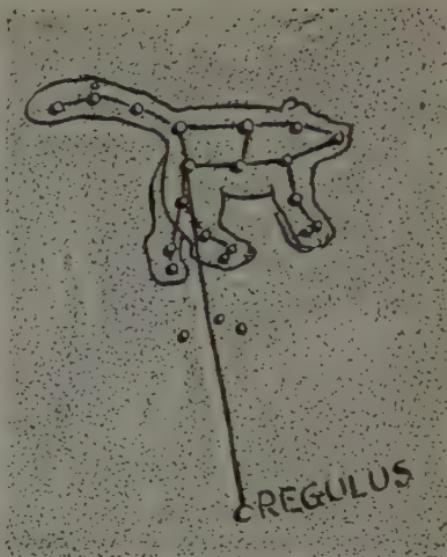
“That’s one lion; the little one. Now we’ll find the big one and draw them both.”

Then Uncle Henry drew a long line through the two stars at the root of the great bear’s tail, and extended it to the three little pebbles in a triangle under the bear’s feet, and through the triangle, and beyond as far again. At the end of this line he put a large pebble. (3)

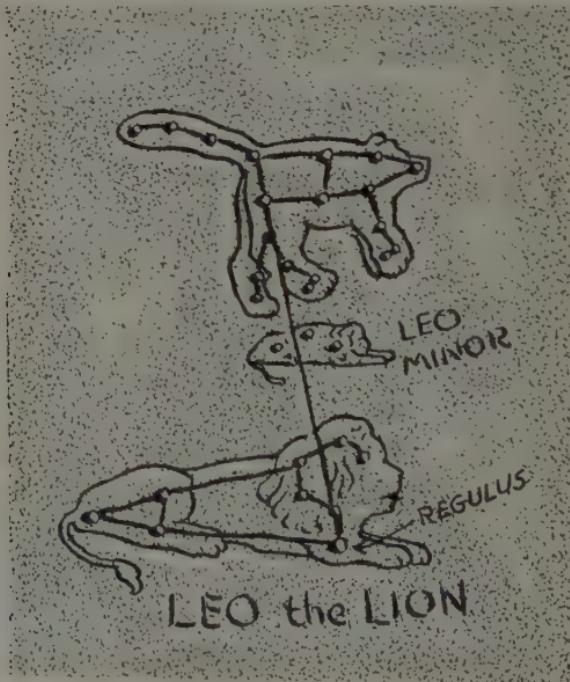
“There,” said Uncle Henry, “is the star *Regulus*,

which is in the big lion's heart. See if you can find the rest of him."

Betty soon picked out the lion's head, and Paul added his hind quarters, and when Uncle Henry had drawn outlines around both big and little lions they looked like this.



REGULUS



LEO
MINOR

REGULUS

LEO the LION

"Now show us the Swan," urged Peter.

"Yes, and the Dragon!" reminded Paul.

"You children haven't forgotten a single one I promised," laughed Uncle Henry. "Well, here goes; everybody find the dipper again."

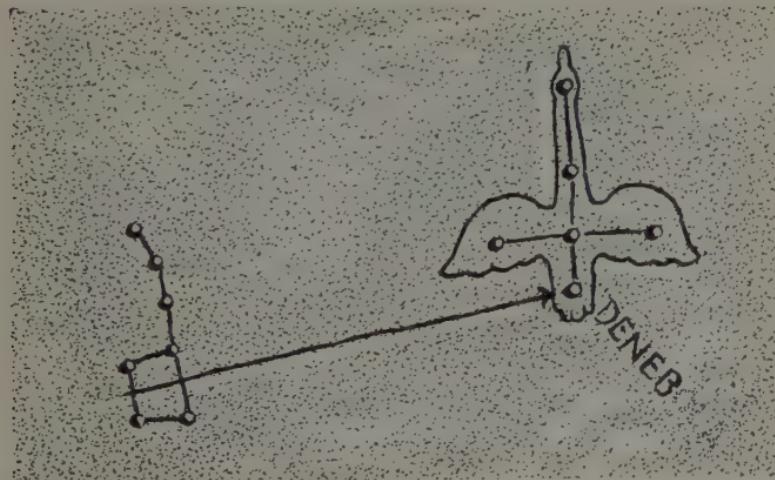
Everybody did.

"Now draw a line straight up through the middle of the dipper's bowl and keep on with it a little over three times the length of the dipper's handle. (4) Put a large pebble there and see if you can find the star. It's in the swan's tail, and he looks as if he was flying overhead, with his wings spread, and his long neck stretched out ahead of him."

"Is he sort of like a cross?" inquired Betty after a moment.

"Right," said Uncle Henry. "Put him in with pebbles."

This shows how to find and draw the swan the way the children and Uncle Henry did.



"Now the dragon, Uncle Hen!" urged Peter.

"Are you sure," said Uncle Henry, "that you promise not to have any bad dreams about the dragon if I show him to you before you go to bed?"

"Sure!" chorused the Society of Star-Gazers.

"Well," said Uncle Henry, "the dragon is very terrible, but he is afraid of bears, so he is squirming away as fast as he can from them. He is wriggling a little faster too, because *Ursa Major* is on one side of him and *Ursa Minor* on the other. Draw a line through the stars in the tips of the swan's wings, back toward the head of the bear-driver, and you'll find the dragon's head about halfway. (5) It's a little triangle of stars, and from that the dragon's body winds around the little bear's body and down above the big bear's back."

"I see all of him!" exclaimed Paul.

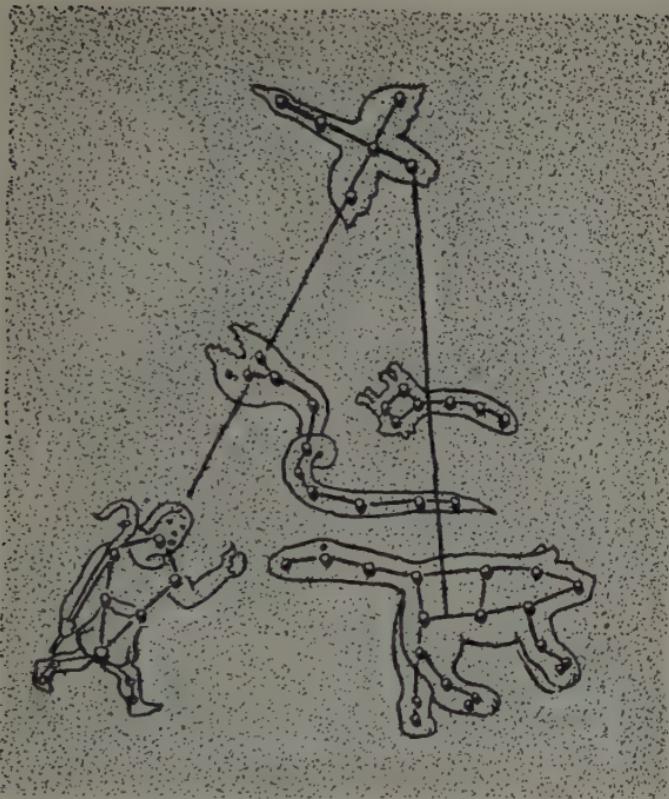
"Here are the pebbles," said Uncle Henry, "put the dragon, or *Draco*, where he belongs."

Paul did, and Uncle Henry finished him.

"To-morrow night," said Uncle Henry, "we'll find some more of the star people and sky animals. They even have musical instruments in this Skyland of ours, so we'll find the lyre that the sky ladies play on! One of the sky gentlemen is a great archer, too, so we'll find him shooting his bow and arrow at a giant scorpion, and——"

"Oh, let's find *that* now!" pleaded Peter and Paul in unison.

Betty did not join in the chorus. She was asleep, with her head in Uncle Henry's lap.



"To-morrow night," smiled Uncle Henry. "Betty will want to hear, too, about the sky lady's mandolin, or harp, or lyre, or whatever it is."

Then he picked up the little girl without waking her, and the boys followed him up the walk into "Seven Oaks"—and bed.

THIRD EVENING

UNCLE HENRY'S MAGIC TURNS THE LYRE INTO A
UKELELE—AND THE ARCHER'S ARROW MISSES THE
LOVELY SWAN AND HITS THE HORRID SCORPION

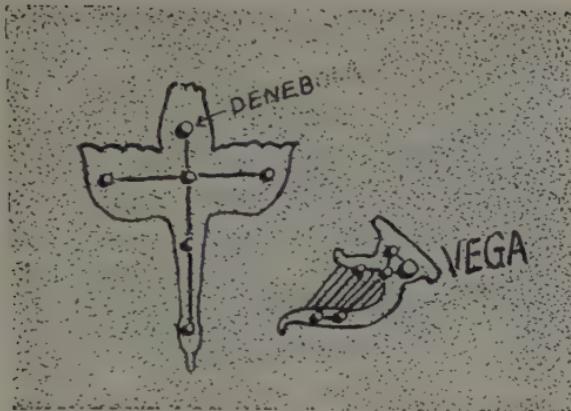
BETTY had been informed by her brothers that Uncle Henry had promised, after she fell asleep, to show the lyre that the star ladies play when they have nothing else to do.

Since she had a new ukelele herself, and was learning to play it, her interest in all stringed instruments was keen, and as soon as the Society of Star-Gazers had come together on the beach the next evening, she demanded that the lyre be found.

“All right,” said Uncle Henry, “find the swan’s wing, on the side of him toward the dragon. Get that? Well then, look for a very bright star between that wing and the swan’s neck, and about the length of the swan’s neck away from the tip of the wing. You can’t miss it, for it’s the brightest star anywhere near. Its name is *Vega*, and some one has called it ‘the arc-light of the sky.’” (6)

“I see it!” cried Betty and the boys together.

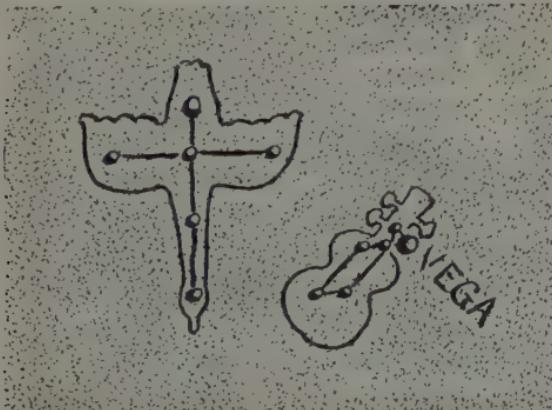
“Look for two smaller stars that make a triangle with *Vega*, and then for three more that make a long diamond shape. That’s right, Peter, put down the pebbles and finish the lyre.”



"It's sort of a harp on a foot!" said Betty in disappointment. "I want to make a ukelele of it."

"Sure, easy as breathing," agreed Uncle Henry, and promptly rubbed out *Lyra* from the sand, and made it over.

After all, Betty was the baby and might have her own way whenever Uncle Henry had anything to say about it. And let no one say that the ancients had all the imagination, after seeing the ukelele that Uncle Henry made of *Lyra*.



"We strive to please," he said as it was finished, and Betty clapped her hands.

"Now we want to see the archer shoot the giant scorpion!" demanded Paul, speaking for the masculine part of the audience.

"Just a minute," said Uncle Henry, "I'm coming to him. You can see one of his arrows if you look on the other side of the swan's neck, just opposite to Betty's ukelele. The archer shot at the swan and missed it."

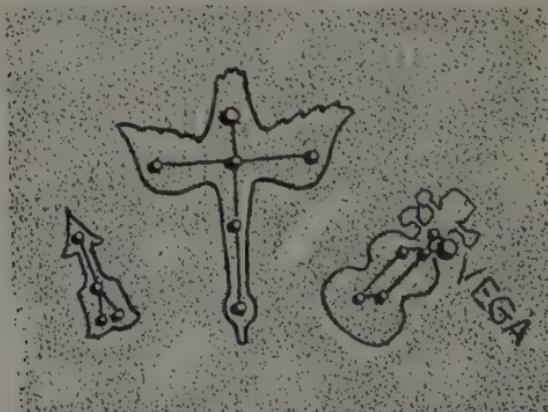
"Serves him right for trying to kill the beautiful swan. I love 'em!" said Betty, with feeling.

"You'll need to use very small pebbles," warned Uncle Henry, "for *Sagitta* is rather small and quite faint."

"What's *Sagitta*?" asked Peter.

"Latin for 'arrow,'" said Uncle Henry.

When the arrow was found and drawn, it was in this position.



"Now the archer!" demanded Paul.

"All right," said Uncle Henry. "Paul, draw a line straight out from the head of the swan, right on in the direction he is flying, and go about twice the length of the swan's neck." (7)

Paul did.

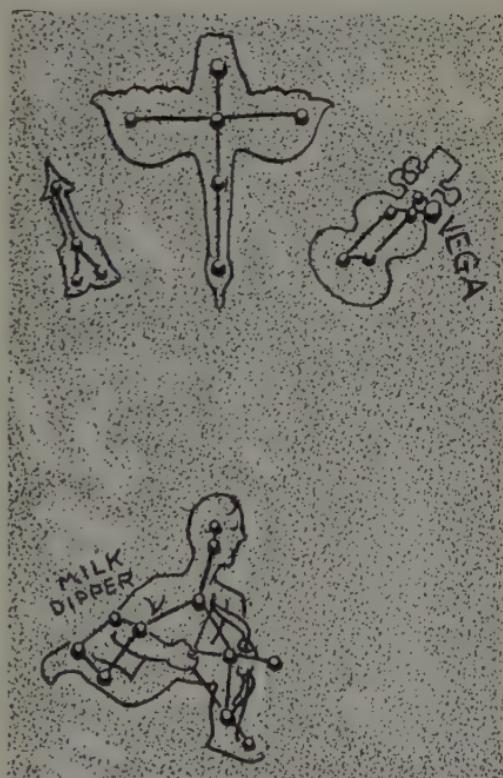
"Now tell me," asked Uncle Henry, "does anybody see anything, about there, that looks like a bow and arrow?"

The children searched the sky at a point a little over two swan's necks ahead of the swan's bill, and Peter cried triumphantly,

"I see it! I see it!"

"Make it then," said Uncle Henry, "and keep the bow in the right position to the swan's neck."

When Peter had all the pebbles in their right positions, Uncle Henry drew in the archer's body, and bow and arrow, and they looked like this:



"He's just getting ready to shoot at the scorpion!" exclaimed Paul.

"Yes," said Uncle Henry, "and the other star people have to look out too. The people who lived long ago called *Sagittarius*, our archer, "the Bull Killer." They did this because when the stars of the archer rise in the east, they seem to drive all the stars of *Taurus*, the Bull, over the western edge of the world. So they said that *Sagittarius* killed off the Bull. We'll find *Taurus* next winter."

"Now let's find the scorpion," urged Peter.

"Wait a minute!" begged Betty, "I see another dipper."

Peter was impatient. Dippers were not interesting, compared with giant scorpions.

"Betty," he remarked, "wouldn't believe there was a little dipper a few nights ago, and now she's seeing 'em everywhere."

But Betty had her way as usual, and the Society of Star-Gazers paused before passing on to the scorpion.

"Where do you see the new dipper, Betty?" Uncle Henry inquired with interest.

"It's right back of the leg the archer is kneeling on." (8)

"You're quite right," Uncle Henry agreed, "and it's called 'the milk dipper,' because it's right on the edge of the milky way."

"Why that's the bowl *Ursa Major* tried to get *Boötes*' hot milk out of, and burned his mouth, and upset!" explained Betty, with a sudden inspiration.

"So it is," agreed Uncle Henry, "although I must

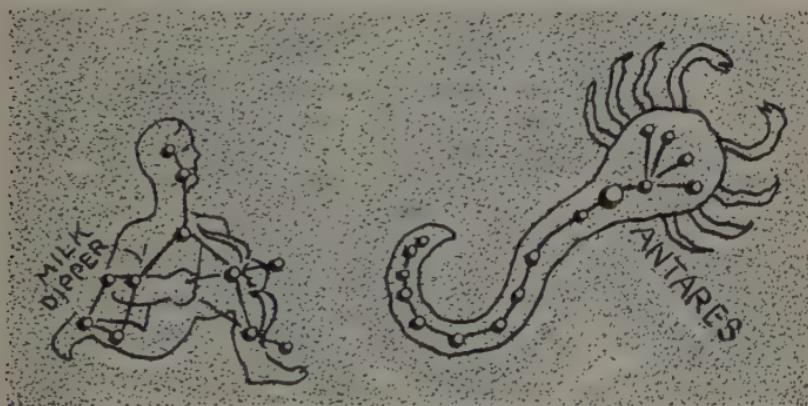
confess I never thought of the milk dipper when I made up that rhyme for you youngsters."

"Now the scorpion!" insisted Peter.

"Oh, have your old scorpion, then, Mr. Peter!" exploded Betty, "I don't want to see the horrid thing. I'm going to the cottage and show Katy the milk dipper."

And she went.

So it was with Peter and Paul alone that Uncle Henry found the scorpion that *Sagittarius*, the archer, is always aiming at. (9) It would have been easy for Betty to find, for it really looks a good deal like a scorpion. See if you don't think so when you've found it.



After Uncle Henry had shown the boys how the big, red star, called *Antares*, in the heart of the scorpion, has a reddish color, Peter suggested that it was probably red because the Archer had already shot an arrow through the scorpion's heart, and made it bleed.

After that, since neither the boys nor Uncle Henry ever wanted Betty left out of anything, and since they knew she would have stayed if Peter and she hadn't wanted different things at the same time, the Society of Star-Gazers adjourned until the next evening.

On the porch, however, Uncle Henry made up this poem and repeated it to Peter and Paul before they went in to bed.

“The Scorpion’s heart has bled,
Antares-star is red,
The Archer made an arrow-wound,
But Scorpio isn’t dead.

The Archer draws his strong-bow,
To shoot a sharp new arrow.
I hope he hits the Scorpion,
And kills the poisonous fellow.”

FOURTH EVENING

THE VIRGIN IS TOO BUSY FEEDING HER SKY POULTRY,
SO CASSIOPEIA GETS THE UKELELE TO PLAY

BETTY, in spite of her pretended lack of curiosity about the scorpion, was down on the beach the next evening ahead of the other members of the Society of Star-Gazers. Uncle Henry found her in the twilight, sitting cross-legged before the sand-drawing of *Scorpio*.

As she searched the southern sky to find the constellation, she was singing Uncle Henry's verses about the archer and *Scorpio* over and over, to a tune of her own improvising.

The boys had made bows and arrows from green saplings during the morning and had raced about for some time with "Rags," in search of giant scorpions to shoot at. They discovered them in the most unexpected objects—trees, rocks, and even boats. The hunt had been accompanied by a war chant, with the scorpion verses for words. It was a faint echo of this that Betty was crooning to herself now.

As Uncle Henry approached her she looked up at him and said,

"Aren't there any ladies among the star people, Uncle Henry? You told about the lyre that they play on, but you haven't shown any of them to us."

"Well, Betty," said Uncle Henry, sitting down beside her, "there are several ladies in our star country, but only two of them are in our sight in the summer time. Let's get the boys and we'll find both the ladies and take a vote to decide which of them shall have your lyre-ukelele to play on."

Betty called, in her high little voice, for Peter and Paul to hurry, and they raced down from the porch with "Rags" in tow.

"Uncle Hen," asked Peter, "'Rags' wants to know if there aren't any more dogs in the sky?" "Sure," said Uncle Henry, "sky folks are very fond of dogs. We've found the two that belong to the herdsman. Besides them, there are two others, but we can't see them 'til next winter. And, of course, there's *Cerberus*, the ugly, monstrous three-headed dog that Hercules killed. We'll find him to-night."

"Oh, that's great!" said Peter, and he and Paul settled down with "Rags" between them. "Rags" looked expectantly at Uncle Henry, who said,

"But first I've promised Betty to find the sky ladies that we can see now, and let one of them have the ukelele."

"Rags'" ears dropped and he lost interest. Peter and Paul, however, remembering Betty's temper of the previous evening, said,

"Of course, ladies first."

"All right," said Uncle Henry, "everybody find *Arcturus* in the hem of *Boötes'* kilt. Get that? Well, then, draw a line in the sand, Betty, from *Boötes'* right shoulder through *Arcturus*, and extend the line

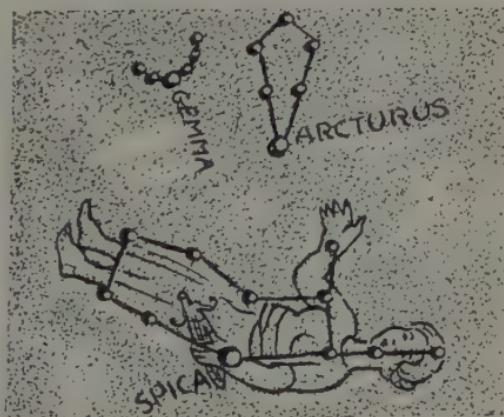
about as far again. (10) Then look in the sky at that point for a bright star.

"I see it!" cried Betty. The boys picked it out next moment.

"Well," said Uncle Henry, "it doesn't look much like an ear of corn, does it? That's what it is, though; an ear of corn held in the Virgin's left hand. Its name, *Spica*, means just that. The Virgin is scattering grains from the ear of corn with her right hand, to attract the birds of Starland—the swan, the eagle, and the dove. We'll find the eagle a little later on, but the dove is so far south that we never see it well. The boys and girls in South America see Noah's dove, but we can't."

"Now," continued Uncle Henry, "follow along northward from *Spica* to a point just below the big lion's tail. There is the Virgin's head. Between it and *Spica* are two fairly bright stars. The one nearest *Spica* is the Virgin's shoulder. Her left arm hangs at her side, from the shoulder to *Spica*, while her right arm extends in the direction of the great bear's tail. Put down the pebbles as fast as you find the stars, Betty."

When Betty and Uncle Henry had finished the Virgin, or *Virgo*, as she is called in Latin, she looked like this:



Then Uncle Henry added the little half circle of small pebbles, with one larger one near the centre, shown in the picture just at the left of Boötes. (11)

"What is that, Uncle Henry?" asked all the children at once.

"Do you see it in the sky?" he asked.

The children quickly found it.

"What does it look like, then?"

Peter thought it was a handful of corn-grains from *Virgo's* hand.

Betty said, "A necklace."

"That's nearest right," said Uncle Henry. "It is called *Corona Borealis*, or the Northern Crown. That brightest star is named *Gemma*, so you see it might be a gem in a necklace, too. The Virgin looks as if she was going to bend over and pick it up. Perhaps she will some day."

"I think," said Paul, "that she's too busy a person to give Betty's ukelele to. Who's the other lady?"

"I quite agree with you," said Uncle Henry. "The Virgin seems very much occupied. Well, there is another lady in Starland. Her name is *Cassiopeia*, and since she has nothing to do but sit in a chair, perhaps Betty will let *Cassiopeia* have the ukelele to play. *Virgo* won't be jealous, either, because she is clear across the sky from *Cassiopeia*; too far away to see. A long line drawn across the sky from *Spica* through the pole star in the little bear's tail-tip will reach *Cassiopeia*. (12)

"She is easy to find, because she looks just like a big letter W. Does anybody see it?"

The trio all found the W very quickly. You will, too, for it is very conspicuous in the northeastern sky in July and August. Uncle Henry showed the children that *Cassiopeia*'s W had to be turned upside down, into an M, before she could be made to sit in her chair properly.

Here is how *Cassiopeia* looked:



"She hasn't a blessed thing to do. We'll give the lyre to her," said Betty.

"I am glad to hear that you are going to give the ukelele to *Cassiopeia*," said Uncle Henry. "Perhaps it will make her feel happier. She has had a rather sad life. Long ago *Cassiopeia* was queen of *Aethiopia*, and was very beautiful. But she was so proud of her good looks that she boasted herself prettier than the lovely sea-nymphs. This made Neptune, the god of the sea, so angry that he sent one of his worst sea-monsters to make trouble along the shore of *Cassiopeia*'s country.

"And as if that wasn't bad enough, Neptune

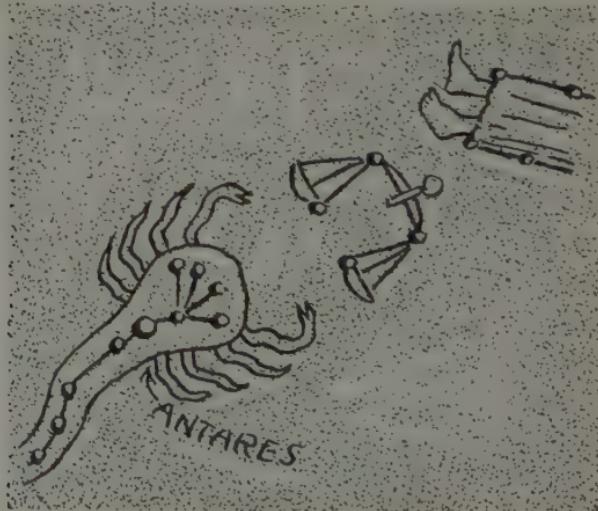
demanded *Cassiopeia's* daughter *Andromeda* as a sacrifice.

"So you see it seems good to see *Cassiopeia* getting a little justice done her, if it's only the present of a ukelele."

"Teacher says," piped up Betty, "that the lady's statue on top of the Court House is '*Justice*.' What does she have that little pair of scales in her hand for, Uncle Henry?"

"The scales are to help her in weighing the good and bad that people do," explained Uncle Henry, "and speaking of scales, there's a pair of them in the sky, too. If you will look between the *Scorpio* and the *Virgin* you will find the scales. (13) They are called *Libra*, which is Latin for 'balance.' There are four main stars in *Libra*, which make an oblong."

This is how *Libra*, the balance, looked when the children and Uncle Henry had finished drawing it:



“Now,” said Peter, with an air of having shown great patience, “we want to see that three-headed dog. I forgot his name.”

“*Cerberus*,” said Uncle Henry, “But in order to find him we’ll have to find *Hercules*, the great strong man, for *Hercules* has *Cerberus* fast by one of his throats and is beating at his three ugly heads with a big club. At the same time, *Hercules* has his left foot on the dragon’s head, so you see he is kept busy.”

“Where do we begin?” asked Paul, impatiently.

“Draw a line,” said Uncle Henry, “from *Vega* in the ukelele to *Gemma* in the *Northern Crown*; the Virgin’s necklace we found a while ago, you know.”

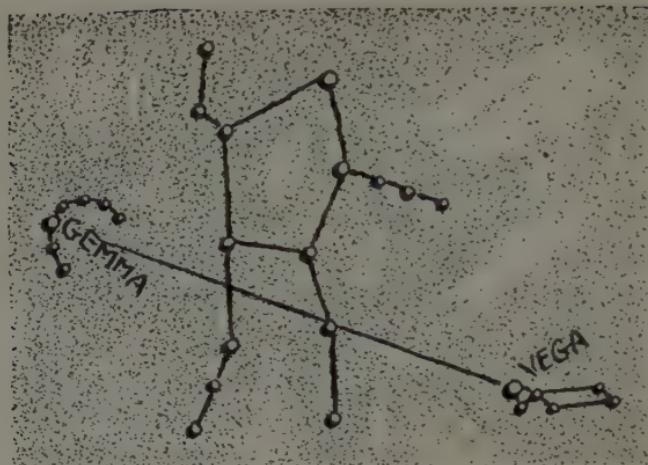
Paul did it. (14)

“Now,” directed Uncle Henry, “look about half-way between, and you’ll find *Hercules*’ legs. His left leg is nearly straight, but his right has the knee bent a little. *Hercules*’ legs and the sides of his body and his belt make sort of an H shape.

“Oh, I see it!” exclaimed Peter. “Shall I make him, Uncle Hen?”

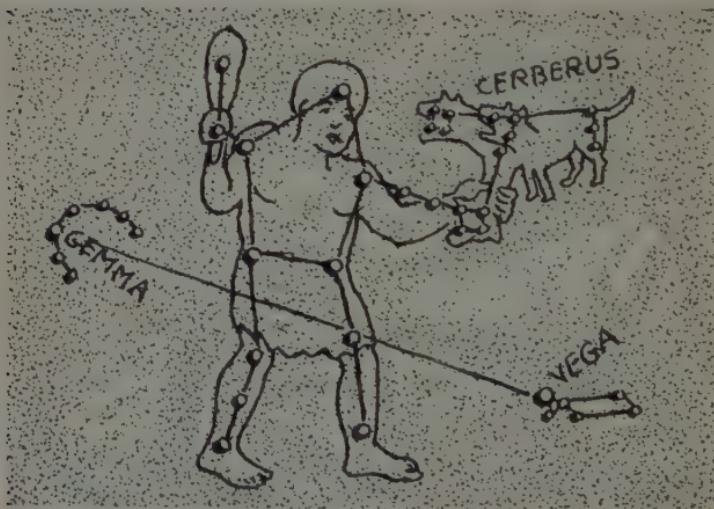
“Sure, go ahead, Pete; and the rest of you watch for *Hercules*’ head and arms.”

When the children had put down pebbles to represent all the stars in *Hercules*, and had connected them with lines in the sand, *Hercules* looked like this:



"Oh," broke out Betty, excitedly, "he's got the ugly dog in his left hand!"

Then she added the three heads of *Cerberus*, and it was Uncle Henry's turn to draw in the outline of *Hercules*, and complete the picture, like this:



"You have probably read," said Uncle Henry, "about the twelve great labors *Hercules* performed. He had to be very strong to do them, but of course he was born that way. They say he even rose up out of his cradle and strangled two serpents that the goddess *Juno* sent to destroy him."

The Society of Star-Gazers became very enthusiastic about *Hercules* after he was all finished. So will you when you see how big and strong and beautiful he is, almost straight over your head in the summer sky just after dark. You will enjoy him more if you lie on your back to look, as the Society of Star-Gazers did on the beach.

While they were all flat on the sand, looking up into the great blue-black, star-sprinkled bowl, Uncle Henry made up this poem, and recited it before the Society adjourned for the night:

"Hercules the strong man—

 Feel his muscle!

 Feel his muscle!

Hercules the strong man—

 See him tussle!

 See him tussle!

Right hand holds a club—

 I can see;

 I can see.

Left hand grips a throat—

 One of three;

 One of three.

Three-head dogs are freaks—
Queer to us;
Queer to us.

That's because you never saw
Cerberus;
Cerberus.

FIFTH EVENING

IN WHICH A DOLPHIN WITH AN EAR FOR MUSIC SAVES
A POET'S LIFE—AND UNCLE HENRY PUTS TWO
BIRDS IN ONE POEM

DURING the next day Peter and Paul had seen a blue-racer in the grass, and, with Rags' assistance, had chased it off into the woods behind the cottage.

So it was only natural for Peter to ask Uncle Henry whether there were any snakes among the star creatures.

Uncle Henry had said, "Two," and promised to show the children a very big one, and an old man having a struggle with it besides.

Peter and Paul were expectantly waiting on the sand when Uncle Henry and Betty came down from the porch that evening after dark.

"Now," said Peter, "where's the snake, Uncle Hen?"

"We'll begin with his head," said Uncle Henry. "Everybody find the northern crown, or *Virgo's* necklace, and *Hercules'* club. Now look just between them and you will see five stars in a sort of little cross, quite close together. Get that?" (15)

The children soon found all five and put down little stones to represent them on the sand.

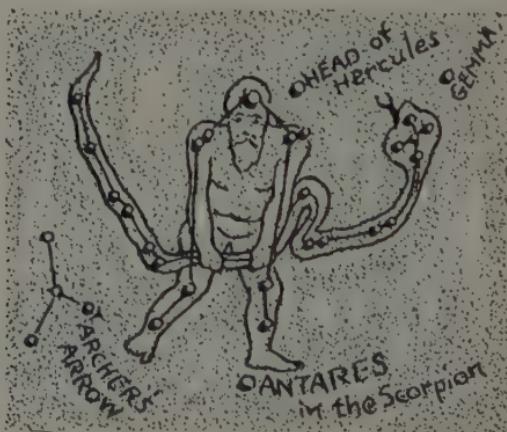
"All right, then; now trace a line from star to star, down toward *Scorpio*, and then across toward

the archer, and then up in the direction of the swan. That line is the *Serpent*. It is writhing in the hands of *Ophiuchus*, the old man who is called 'The Serpent-bearer.' His head and *Hercules*' head are only a little way apart. Look for a bright star just east of the bright one in the head of *Hercules* and you will have the head of *Ophiuchus*. Then look where his shoulders would naturally come and you will see two stars close together in each shoulder. Find them?"

The children did, and placed pebbles for the head and shoulders of *Ophiuchus*.

"Now," said Uncle Henry, "draw two long lines down from the shoulders, through the Serpent and beyond, and you will have the old man's body, legs and feet. One foot is just in front of the archer's bow; the other is just above the red heart of *Scorpio*. You will have to imagine his arms, and his hands holding the serpent while it squirms."

When all the pebbles were down and all the lines were drawn, *Orphiuchus* and the serpent, or *Serpens* in Latin, looked like this:



"Are there any more snakes, Uncle Hen?" inquired Paul expectantly.

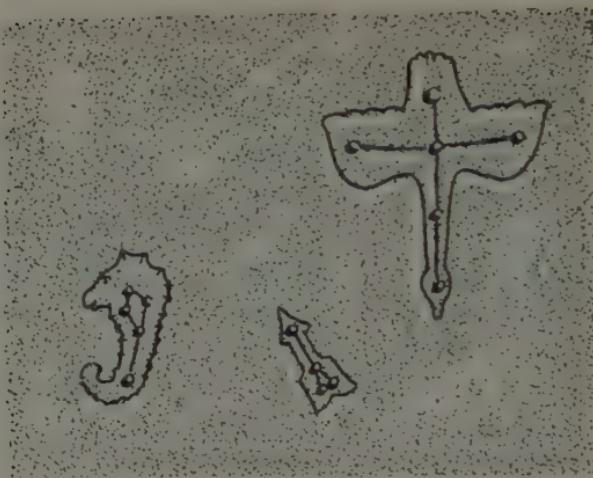
"Yes, a sea-serpent made of very faint stars," said Uncle Henry, "but he is rather hard to trace out and the only other creature I have left now that is anything like a snake is a dolphin, or porpoise, and he isn't much like one. We'll find him, anyway, and then if you prefer to make a sea-horse out of the dolphin, or *Delphinus*, as you would say in Latin, why go ahead and do it. The animals in Starland are very obliging. They will turn into anything you like to see in them."

"Where is the dolphin, Uncle Henry?" asked Betty.

"Well," said he, "draw a line through the beak of the swan and the arrow, or *Sagitta*, and it will strike *Delphinus*. (16) The arrow is about halfway between the swan and the dolphin. See it?"

The children soon found the dolphin and mapped his skeleton with pebbles. Then Uncle Henry put it to a vote of the Society of Star-Gazers whether *Delphinus* should be finished up as a dolphin or a sea-horse. The vote was two to one for the sea-horse.

Uncle Henry drew a sigh of relief; he didn't know quite what a dolphin looked like, and he had seen a picture of a sea-horse in the dictionary only the day before. So *Delphinus* turned out to look like this. If you insist on having him a dolphin, why draw him differently yourself:



"I wonder," said Betty thoughtfully, "who rides the sea-horses. Do the mermaids, Uncle Henry?"

"I don't know about the mermaids," he answered, "but I do know that an ancient poet and musician, named *Arion*, was saved from drowning by riding to shore on a dolphin. It was like this:

"Arion had gone from his home on the island of Lesbos to Italy, and while there had made a great deal of money by his singing."

"Just like Caruso in New York," exclaimed Paul.

"Yes," said Uncle Henry, "and also like Caruso, *Arion* decided to go home for a visit. Well, on the way to Lesbos the sailors decided to murder *Arion* and get all the money he was taking home with him. He had gone on a regular pirate ship you see. The pirates were all ready to kill *Arion*, but he begged so hard to play just one little melody on his lute before he died that the pirate sailors said, 'Yes, he might

play just one.' You would hardly believe it, but the melody that *Arion* played was so catchy and tuneful that it attracted a number of dolphins, who began to dance and turn somersaults about the ship. Then *Arion* watched his chance—and jumped overboard—and one of the friendly, music-loving dolphins carried him back to Lesbos on his back."

"My, but I'm glad he got away from those awful pirates!" cried Betty with heartfelt fervor.

"It's too bad the horrid sailors got his money after all," said Peter. "If they hadn't he might have got something nice for the dolphin to eat when he got to that place where he lived."

"The dolphin fared better than that," Uncle Henry assured the children. "It pleased the sea god *Neptune* so much to have one of his creatures save a poet's life that he had that dolphin put in the sky among the stars, and we see him there now as the constellation *Delphinus*."

"What's next?" demanded Peter when the story of *Delphinus* was finished.

"The next three," said Uncle Henry, shaking his head sadly, "are the last."

"The last?!!" chorused the Society of Star-Gazers incredulously.

"Well, maybe not absolutely the last," admitted Uncle Henry, "but the last for this Summer. There is a whole dozen more of the Star People in our northern sky, but we can't see them until next Winter."

"Why?" inquired Betty anxiously.

"It's a long story," said Uncle Henry. "Some-time I'll tell you all of it, beginning with the fact that the pole of the earth always points to the north star, where the little bear's tail is fastened, you remember. I promise to show you all the rest of the star animals and people when I come home for my Christmas vacation. Will that do, if I show you a wonderful eagle to-night—and a sea goat and a water carrier to finish up with?"

The children were disappointed, but they trusted Uncle Henry. He wouldn't stop showing animals and people until he had to; they all knew that.

Peter said,

"We'll have a whole dozen to look forward to next Christmas. Sort of a present from Uncle Henry. Come on, Uncle Hen, let's find the eagle and the sea goat and water carrier!"

The others agreed with Peter.

"The eagle, or *Aquila*," said Uncle Henry, "is easy to find because of a very bright star, called *Altair*, which is right in his neck. You will find it near the arrow, or *Sagitta*, between the end of the serpent's tail and *Delphinus*. (17) Does anybody see *Altair*?"

"I do," said Betty, "it's right between two other stars that aren't so bright."

"Right," said Uncle Henry. "Put down pebbles to represent all three, Betty, and we'll find the rest of the eagle, or *Aquila*, as it would be in Latin."

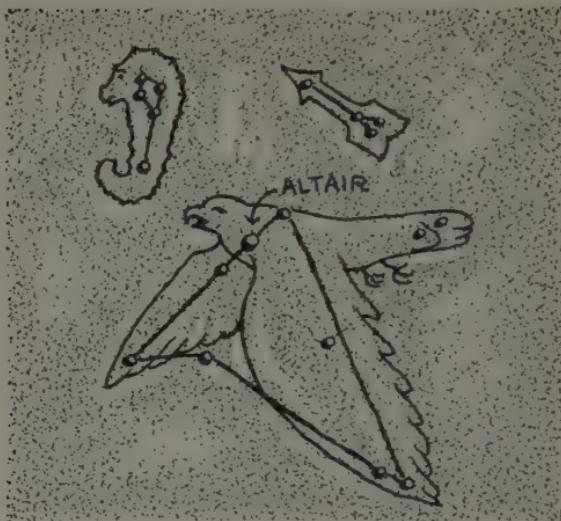
When the three pebbles were in place they stood in this relation to *Sagitta* and *Delphinus*:



"Now," said Uncle Henry, "draw a line downward through the three stars and a little more than twice as far again and what do you see?"

"Another star," said Paul.

"Put it in," said Uncle Henry, "and then draw another line from the upper of the first three stars in the direction of the handle of the 'milk dipper' in *Sagittarius*, the archer. Continue this about four times the length of the line that joins the first three stars together and you will find two fairly bright stars close together. That's right, Paul; put in the star you find about halfway down the line, too. Now draw a line from the two fairly bright stars back in the direction of the tail of the sea-horse, or *Delphinus*, until it almost meets the first line you drew. There you will find another fairly bright star. Now it is easy to finish the eagle's skeleton."



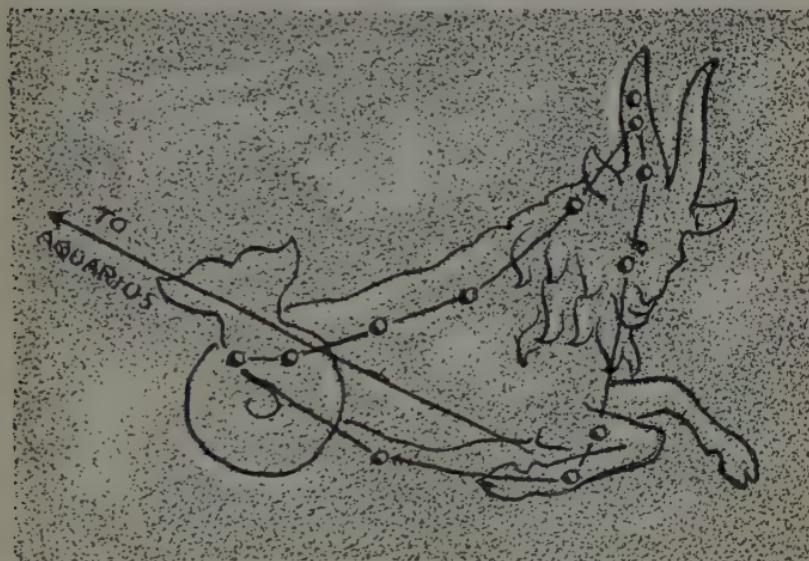
When the eagle's skeleton was finished Peter thought it looked more like a big arrowhead than an eagle, but when Uncle Henry had drawn the outline of *Aquila*, the Society of Star-Gazers admitted the resemblance to the bird.

"Now where's that sea goat?" inquired Peter.

"Follow the line of the first three stars we found in *Aquila* downward, and just a little way beyond where it ends in the tip of the eagle's wing you will see two rather faint stars, close together. (18) They are at one corner of a 'cocked hat' such as you make out of newspaper when you play soldier—sort of a Napoleon's hat. It is upside down. When you find it and put down pebbles for stars I'll show you how the good imaginations the ancient people had turned the cocked hat into a sea goat."

This shows how *Capricornus* the sea goat looked

when the children and Uncle Henry had finished him. I leave it to you to decide whether or not he looks more like a cocked hat.



"When we have found *Capricornus* the sea goat," said Uncle Henry, "it is easy to find *Aquarius* or the water carrier. Just prolong the line that connects the goat's right foot with his tail until it runs close to a little triangle of three stars with another in the centre. (19) It looks a little like the head of the Serpent we found squirming in *Ophiuchus'* hands, but it is the water-jar *Aquarius* is carrying."

"Oh, I see it," cried Paul.

The other stars in *Aquarius* were soon found and represented by pebbles. Then Uncle Henry drew

the outline that finished the Water-Carrier, like this:



"Now we're all through?" inquired Betty.

"Until next Christmas," smiled back Uncle Henry.

"Can't we have just one more poem?" teased Paul.

"What shall it be about?" asked Uncle Henry, with the air of a man who could write a poem to order on any subject.

"One about the lovely swan," commanded Betty, "you haven't made one up about the swan."

Uncle Henry was in a quandary; he wanted to please everybody with the last poem. He lay down on his back and looked up at the sky for so long that the children thought he must have fallen asleep.

Finally Uncle Henry began to recite,

“The eagle of Starland
Got tired of his tree,
And challenged the swan to a race.

“Come up from the water!
Fly up and be free!
To northward I'll beat you a chase.”

The swan thought of shivers
And icebergs and frost—
He made up his mind to race South.

So they are still flying—
Their race can't be lost—
Till Gabriel blows with his mouth.”

“What'll Gabriel blow?” inquired Peter when the hand-clapping had stopped.

“His trumpet, of course, silly!” answered Betty for Uncle Henry.

Just then the children heard a toot from an automobile horn that they all recognized, and the Society of Star-Gazers raced with Uncle Henry back up to “Seven Oaks Cottage.”

“Sister” and “the Children's Father” had come back from their trip and had surprised everybody.

The summer sessions of the Society were over.

FIRST WINTER EVENING

THE "SOCIETY" LEARNS WHY ORION NEEDS A CLUB
TO KEEP FRISKY TAURUS IN ORDER—AND WHY WE
SAY "BY JIMINI!" WHEN WE GET EXCITED

UNCLE HENRY came, as he had promised, to spend his Christmas holidays with "Sister," "the Children's Father," Peter, Paul and Betty, in their city apartment.

The children's hope for fair weather in Christmas week was not disappointed either. The days were snowy and sunny and the nights frosty and clear.

Only one thing had worried the "Society of Star-Gazers"—what was to take the place of the smooth sand of the beach when Uncle Henry should begin to point out the sky people that were visible in the winter sky? There were pebbles, it was true, on the flat roof of the apartment house, but there was no sand.

The children were certain, however, that Uncle Henry would find a way, as he always did, and sure enough, when he arrived he brought, as one of his Christmas gifts to the children, a wonderful blackboard, an easel to stand it upon, and plenty of white chalk.

After dinner on the first night of Uncle Henry's visit, the Society of Star-Gazers was bundled up in warm coats and mufflers and he led the way to the

roof, carrying the blackboard and his pocket electric flashlight.

Far above the lights of the city arched the great, blue-black bowl of the sky, filled with the sparkling patterns of stars that the children had learned to know as steadfast, unchanging friends.

"Uncle Henry," said Betty, "you've told us about enough animals to really fill a Noah's ark, but we've never heard anything about Noah himself. Isn't there any Mr. Noah in the sky?"

"Well, Betty," said Uncle Henry, "There isn't any constellation that's named for Noah, but he was a great hunter, and since there is a great hunter in the sky, we can call him Noah if we want to, even if his last name is *Orion*."

"Noah O'Ryan!" laughed Paul. "I know a boy named Michael O'Ryan."

"It's not the same spelling," said Uncle Henry, as he turned the flashlight on the blackboard while he wrote the word upon it, and underneath, made three large chalk dots, like this:

"Find those three stars," said Uncle Henry, "and you will have the *belt of Orion*. It ought not to be hard to find them, for there are no other stars like



them anywhere in the whole sky. Those three stars have always attracted a lot of attention from people in all times and countries. In the Bible Job calls them 'the bands of Orion'; the Arabs called them 'the Golden Nuts'; the fierce Masai Tribe in Africa call them 'the three old men'; the ancient Chinese named Orion 'Tsan,' which means 'three'; and to the Eskimos these three stars appear to be the three steps that a Starland Eskimo cuts in a snowbank when he wants to climb to the top of it."

The children soon found *Orion's* belt about a third of the way up the southeastern sky.

"Now," said Uncle Henry, "see who can find his shoulders first. Here is a piece of chalk for each of you. Put the shoulders in as soon as you see them."

Paul found *Orion's* right shoulder, and Betty his left, and made large chalk dots to show how bright and beautiful the stars that mark the shoulders are.

"Oh, I see his feet!" exclaimed Betty delightedly.

"Put them in then," said Uncle Henry.

Then *Orion* looked like this on the blackboard:



“I’ll tell you this much more,” said Uncle Henry, “and then you must finish *Orion* by yourselves. He has a great club, raised, ready to strike, in his right hand, and he holds a lion’s skin on his left arm, as a shield.”

“What’s he going to hit at?” inquired Peter, with his boy’s joy in battle uppermost.

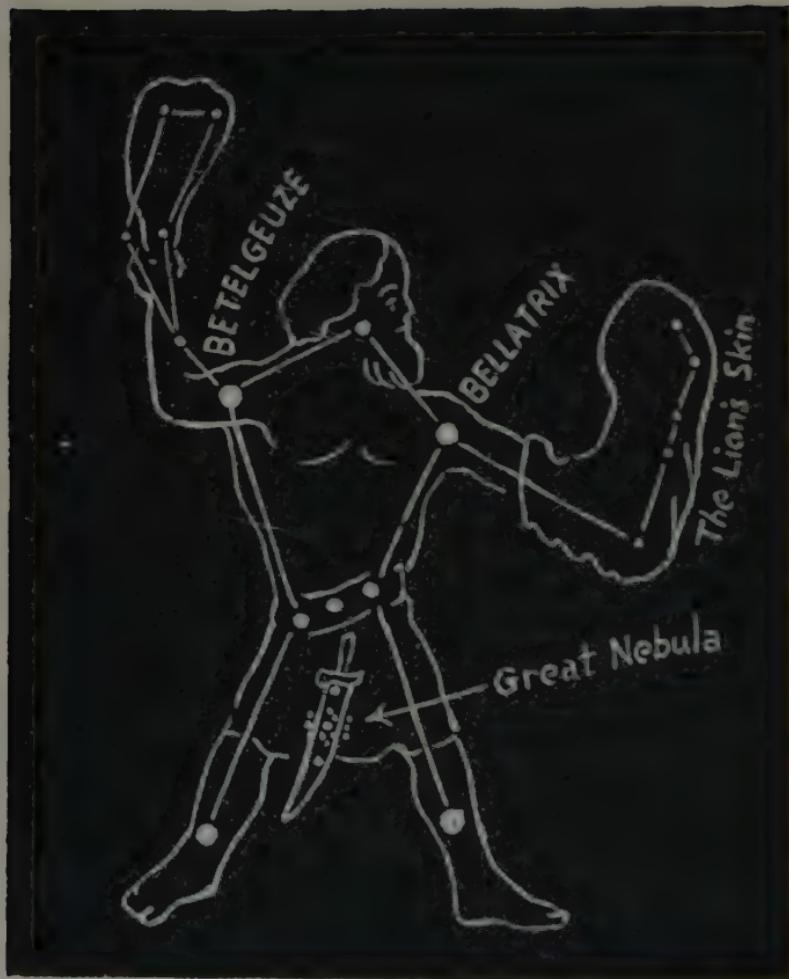
“At *Taurus*, the wild bull,” said Uncle Henry. “You see that *Taurus* is very fierce, and would enjoy nothing better than to chase the twin star boys round and round the sky. He might not really want to hurt the boys, whose names are *Castor* and *Pollux*, but *Taurus*’ horns are very sharp and he doesn’t know how to play gently, so it keeps *Orion* pretty busy getting between him and *Gemini* and threatening the bull with his club.”

“What’s ‘jimini,’ Uncle Hen?” said Paul. “Sounds like our swear word.”

“It is the origin of it,” said Uncle Henry. “The ancient Romans used to swear ‘by *Gemini*,’ and it has slowly been changed into your ‘jimini.’ *Gemini* is the Latin word that means ‘twins.’ We’ll find them after we finish up *Orion* and *Taurus*, and then you’ll see just how *Orion* keeps protecting them from the bull.”

“Hurry up, Uncle Hen!” urged Peter. “I’m dreadful excited!”

Uncle Henry did, and as a result *Orion* looked like this:



"Ooh! he's got a sword, too!" cried Paul, as Uncle Henry added the three tiny stars below *Orion's* belt, and drew the outline around them.

"Why didn't he use the sword on *Taurus*?" asked Peter.

"Because he knew *Taurus* was only playing in his rough way," Uncle Henry replied.

"Well, we've heard a lot about that bull," said Betty. "Let's find him right away."

Uncle Henry said nothing, but took the chalk from Betty and drew a light line from *Orion's* right foot to his left shoulder, and continued it upward about the same distance. (20)

"There," he said, "that point is just between the bull's horns and over his right eye. The right eye of *Taurus* is a very bright star called *Aldebaran*. Anybody see it?"

"Oh, I do!" said Paul. "What, hasn't *Taurus* any left eye, Uncle Hen?"

"He has," said Uncle Henry, "but he has it closed just now. He's winking it at *Orion* as much as to say, 'Oh, I act fierce, but I wouldn't hurt those twins after all. I'm just playing.' Go ahead and put in the stars for the bull's head and horns as fast as you find them, youngsters."

The children did, and when Uncle Henry had showed them the fore legs and shoulder, which contains the beautiful little group of faint stars called the *Pleiades*, *Taurus* looked like this:



"Now we want the twins!" cried Betty.

"All right," said Uncle Henry, "follow a line straight up the bull's left horn and a little more than the length of the horn beyond its tip and you will reach *Castor*, the head of the fainter twin." (21)

Peter and Paul began to show great interest, because they were twins themselves. They demanded that each be allowed to select one of the sky children and finish him completely, without Uncle Henry's assistance.



Paul, having first choice because he was twenty minutes younger than Peter, selected *Pollux*, and Peter had to be contented with the less bright *Castor*.

It was not a difficult task for either of the boys, after finding the twin star *Castor*, for the head of *Pollux* is quite close beside it and the bodies of both star children stand side by side, with the feet just above *Orion's* uplifted club.

When *Gemini*, the twins, were finished, the black-board looked like this, and since the children's fingers were so stiff with the cold that they could hardly hold the chalk, Uncle Henry moved that the Society of Star-Gazers adjourn until the next evening.

SECOND WINTER EVENING

IN WHICH THE DOGS OF ORION AND GEMINI FOLLOW
THEIR MASTERS, PEGASUS ESCAPES AS USUAL, AND
ANDROMEDA GETS A NICE SOFT BED OF HAY IN
PLACE OF HER HARD OLD ROCK

“UNCLE HEN,” said Peter, when the Society was assembled round the blackboard, in overcoats and mittens, on the following night, “what is that very bright star that is down behind *Orion*? It looks sort of important to me.”

“Right you are, Pete,” answered Uncle Henry, looking where the boy pointed, “it *is* important. It is the star *Sirius*, the brightest star in the whole sky. We’ll begin with it and find *Orion’s* dog, or *Canis Major*, which is Latin for ‘bigger dog.’”

“That’s great!” exclaimed Paul, “you told us last Summer that we’d find him this Christmas-time.”

“So I did,” agreed Uncle Henry. “Well, you can always find *Orion’s* dog by drawing a line through *Orion’s* belt and extending it behind him until it meets *Sirius*. (22) You can’t miss it because it’s so bright. Everybody see it?”

Everybody did.

“Now,” went on Uncle Henry, “extend the line that came from *Orion’s* belt, curving it slightly downward after it passes through *Sirius*, and you will have the dog’s backbone. Put in the chalk

dots as we find the stars, Pete. Now draw lines upward and downward from *Sirius*, at right angles to the backbone line and you will have the dog's forelegs and ears. At a point on the backbone about twice the length of the foreleg from *Sirius*, you will find another fairly bright star, and below it a little way another star. Connect these two and keep on with the line, at right angles to the backbone, and you will find one hind foot. The other is not far in front of it. Yes, that's right, Betty, there's a star in the tip of his tail, too. And the three stars near *Sirius* make *Canis Major's* nose."

The children soon finished the skeleton and Uncle Henry took the chalk and put the flesh upon it. Then the dog of *Orion* looked like this:



"He's a faithful old fellow, isn't he?" said Betty, "to always follow Mr. *Orion* around like that?"

"I'm not always sure," said Uncle Henry,

“whether the dog of *Orion* would always be so faithful if it wasn’t for the rabbit that is always just ahead of him, almost under *Orion’s* feet.”

“Oh, show us the rabbit!” cried Betty. Her father had promised her that when they all went to live in a house in the country, she should have a pair of them for her very own.

“All right, Betty,” said Uncle Henry. “You can find *Lepus*, the rabbit, yourself. The three rather faint stars just below *Orion’s* right foot make the curve of his back. Join them together with a curved line and extend it forward and downward until it passes through two brighter stars. The lowest of these is in the fore-shoulder of the rabbit. Now draw lines backward from both of these brighter stars, at about right angles to the line that joins them, and you will find the rabbit’s hind hip and hind foot. He is lying down for a moment to rest. You see he’s been galloping away from *Canis Major* for such a long time that he is tired.”

“Poor little rabbit!” cried Betty, and her little face looked so pitiful in the light of the electric torch that Uncle Henry hastened to reassure her by saying that the big dog had never yet caught the rabbit, and by the very nature of things never could. Then she took heart to go on putting in the stars.

“Now,” said Uncle Henry, “you can find the star in the rabbit’s eye by drawing a line forward from the upper one of the brighter stars, and the star in his fore-foot by drawing another forward and downward from his fore-shoulder. That finishes his

skeleton, all except his ears. They are made by finding four faint stars just under *Orion's* left foot, and using two of them in each ear."

"Now can I draw his outline in, too?" asked Betty. "I want to make every bit of him myself."

"Of course you can!" exclaimed Uncle Henry indulgently.

"You've got to let me make all of the horse, then, when we come to him!" exclaimed Peter.

"In just a little while, Pete," said Uncle Henry, "we're making the rabbit now."

"All right," agreed Peter.

Betty had looked longingly at rabbits in pet stores so often that she really did very well at drawing the outline of the sky-rabbit.

We leave it to you to better it. You can't—unless you love rabbits more than she did.



Betty's brothers were quite astonished, and pleased the little girl immensely by clapping their hands when the rabbit was finished.

"Now let me do the horse!" demanded Peter.

"What'll be left for me to do?" inquired Paul wistfully, "if you let Pete do the horse?"

"That'll be all right, Paul," reassured Uncle Henry, "the sky horse is very large, but we'll give you two smaller animals to do yourself to make up for him—*Aries*, the ram, and *Canis Minor*, the smaller dog."

"Fine," agreed Paul. "I know all 'bout rams."

The children laughed gleefully. Paul had been butted over once by a ram when they were on a summer visit to their grandfather's farm.

"Well, Pete," said Uncle Henry briskly, "you'll find *Pegasus*, the horse, grazing clear on the other side of the star field. Somebody built a box stall for him over there, but he's so big and strong that he doesn't stay in it except when he feels like it. He's all the time leaping the fence and escaping. When you find him, you'll see that he's doing that very thing now. In fact, you'll catch him right in the act!"

"Oh, let's hurry then!" said Peter, "he might be out before we see him do it!"

"Everybody find the big dipper," directed Uncle Henry. "You remember how we found the pole star in the tip of the little bear's tail by drawing a line up through the 'pointer stars' of the dipper's bowl; on the side away from the handle? Well, do that again now, and follow the line through the pole star,

passing behind *Cassiopeia* in her chair, and continuing until your line passes through two fairly bright stars quite a distance apart. (23) A line connecting these stars marks the top edge of *Pegasus'* box stall, which is called 'the square of *Pegasus*.'"

"*Cassiopeia* is about halfway between the pole star and *Pegasus*. A line drawn from the pole star through the back of *Cassiopeia*'s chair will reach the two stars that form the lower corners of *Pegasus'* box stall." (24)

"Oh, I see the square now," said Peter.

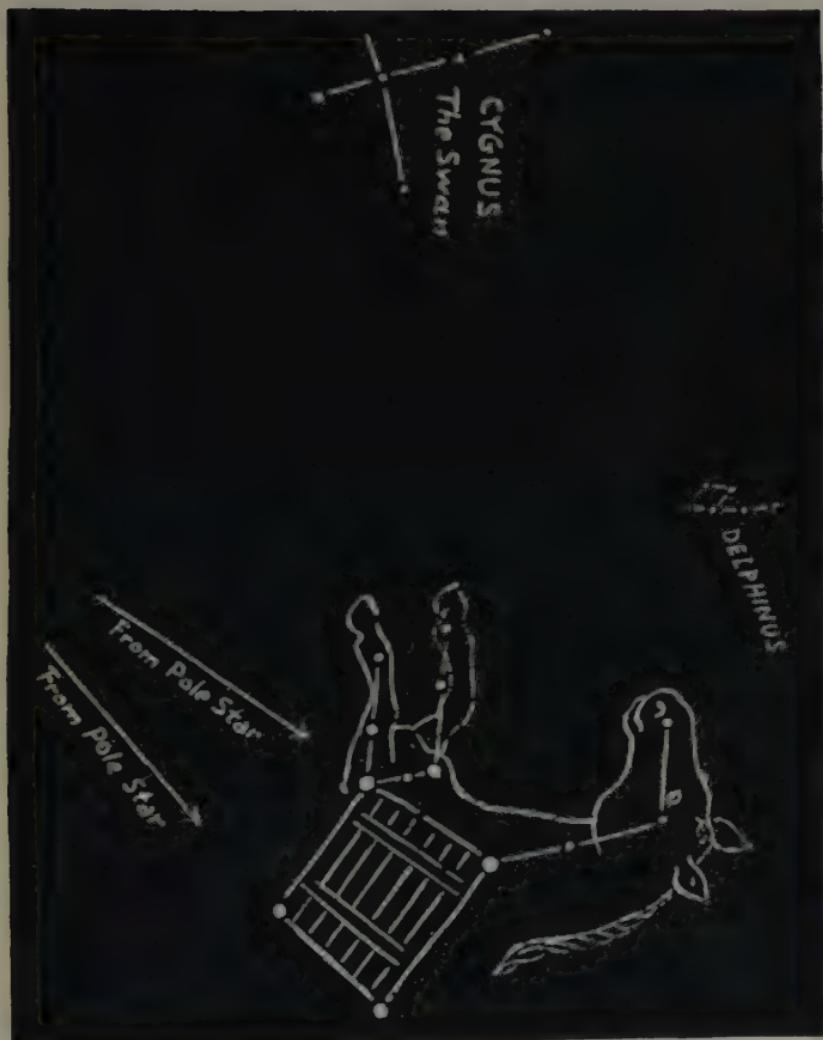
"Me, too," said Paul.

"It's very big, isn't it?" said Betty.

"Yes," agreed Uncle Henry, "and *Pegasus* is big, too. He is upside down just now, with his head just above the western horizon. His nose points northward toward *Delphinus* and his neck curves up from the side of the box stall that's away from the pole star. His fore feet curve up from the side of the square that is toward the pole star, and both feet point toward the swan."

"I see him now," cried Peter, and began putting in the chalk dots and lines for the framework of the box stall and the skeleton of *Pegasus'* head and forelegs, which are all of him that can be seen. As Uncle Henry said, *Pegasus* is just in the act of jumping out of his stall.

When Peter had finished drawing *Pegasus*, the horse of poets looked like this. Uncle Henry put in the arrows pointing from the pole star, and the skeletons of *Delphinus* and the swan.



"It seems to me," observed Paul sagely, "that *Pegasus*' box stall is a lot too small for him."

"That's why he is all the time jumping out and running away," explained Uncle Henry. "I told you that we should catch him in the act. He's always at it."

"Pete's had his turn; now I want to find the ram and the little dog," said Paul.

"If you'll wait just a little longer," said Uncle Henry, "I'd like to show Betty the last of the sky ladies, because she's right close to *Pegasus*."

Paul's face fell a little, but he said, "Ladies first, of course," as any gentleman would.

"I said she was a lady," said Uncle Henry, "but I'm not so sure that she is acting like one. In fact, she is in an attitude that few ladies would like to be seen in, at least not in the plain view of everybody who looks at the sky."

"What's she doing, Uncle Henry?" inquired Betty, in a tone that said, "I guess it can't be anything so *very* bad."

Betty was herself fond of climbing trees, in spite of motherly disapproval of such tomboy activities.

"She's lying flat on her back, with her arms and legs sprawled out and her head resting against the corner of *Pegasus*' box stall. I should think it might be very uncomfortable for her, unless she is lying on a pile of hay, for *Andromeda* has been there a very long time in the same position. The ancient Greeks said that *Andromeda* was chained to a

rock. Let's not have her that way; it would be so disagreeable."

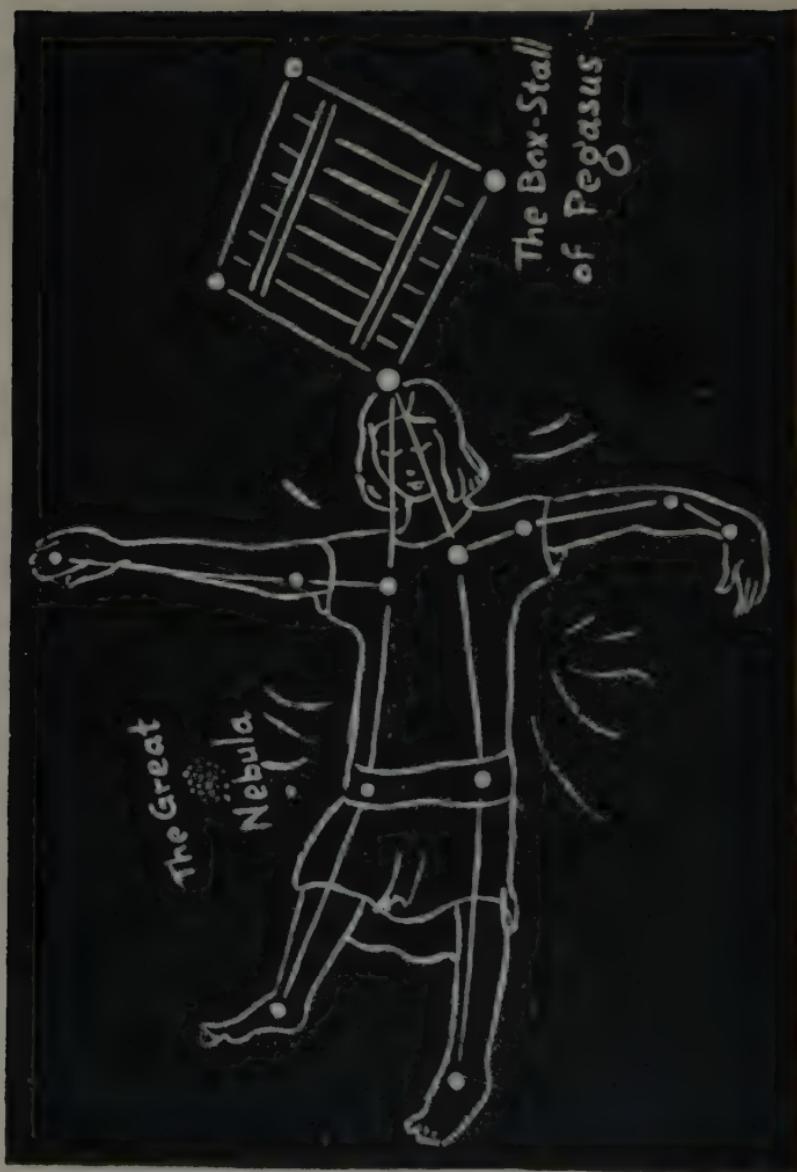
"She's probably asleep and doesn't notice, but we'll give her the hay," said Betty. "There's nobody to tell her not to lie down where she likes. How do we find her, Uncle Henry?"

"First look for her head," said Uncle Henry. "It is the same star we found forming the lower corner of *Pegasus*' square on the side toward the pole star. *Andromeda*'s feet are just below the W-shaped *Cassiopeia*. A line drawn from the swan's beak through his tail, and extended across the sky, will reach the stars in the feet. (25) Another line drawn diagonally across the square of *Pegasus* to *Andromeda*'s head and extended will pass along her body, and farther on, her left foot will be seen just above the line. You see her now, don't you, Betty?"

"Yes," said Betty, "and I think I see her arms."

"All right, draw her in," Uncle Henry encouraged.

Betty did, but didn't think she could draw well enough to outline the sleeping girl, so Uncle Henry did that. Then *Andromeda* looked like this:



Betty added a few lines to show that *Andromeda* was lying on a pile of hay, instead of being chained to that hard rock the Greeks insisted upon.

"What is that fuzzy little star just to her right, about at her hip?" asked Paul.

"I'm glad you noticed that," said Uncle Henry. "The astronomers who lived ever so long ago, long before the birth of Christ Jesus, noticed that it looked 'fuzzy,' just as you have, and called it 'the little cloud.' It is now called 'The Great Nebula in *Andromeda*.' If you looked at it through a telescope you would see that it is not one star, but a great many. Some of them, as astronomers who live now tell us, are as large as our sun."

"Ooh, how wonderful!" said Betty softly, and the boys' faces showed that they thought so, too.

"Some night," promised Uncle Henry, "we'll bring up a little telescope and look at 'the little cloud' again. It is a fine sight."

"Now," said Paul after a moment, "please can I find the ram and the little dog?"

"Certainly," said Uncle Henry. "Just as *Canis Major*, the bigger dog, follows *Orion* and belongs to him, so *Canis Minor*, the littler dog, follows and belongs to the star children, the twins named *Gemini*."

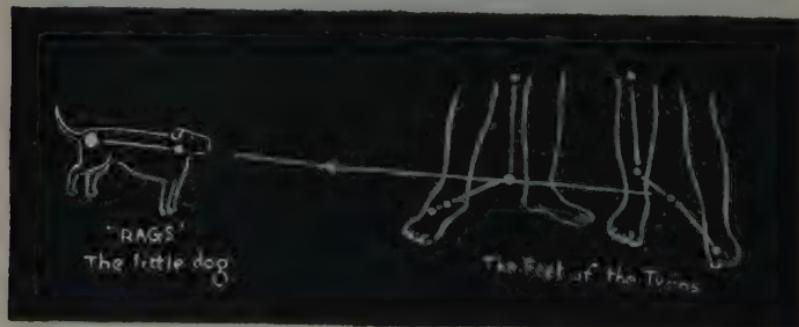
"Ooh!" exclaimed Betty, "just like 'Rags' belongs to Peter and Paul! We'll call the little dog 'Rags' when Paul finds him."

"Fine!" laughed Uncle Henry, "but I warn you that he won't come when you call him as well as the real live 'Rags' answers to his name."

"Where do I start?" inquired Paul, anxious to have his chance to draw.

"At the feet of the twins," directed Uncle Henry. "Draw a line through their feet and extend it away from the feet of *Pollux*, in the direction away from *Taurus*, the bull. (26) At a point about as far away from the foot of *Pollux* as the height of the twins you will find a bright star, and between it and the foot of *Pollux* a fainter one. Draw a line to connect them, and you have the little dog's backbone. You can fill in the rest of him any way you like, for those are the only two stars he has in him. I'll tell you one thing, though. The brighter star is at the little dog's tail instead of his head. The opposite was the case with *Orion's* dog."

The children found the two stars very easily and Paul put down dots of the right size to represent them. Then he drew the outline of the little sky dog, making him an Airedale, as you can see, so that he might be the same as his beloved flesh and blood name-sake "Rags."



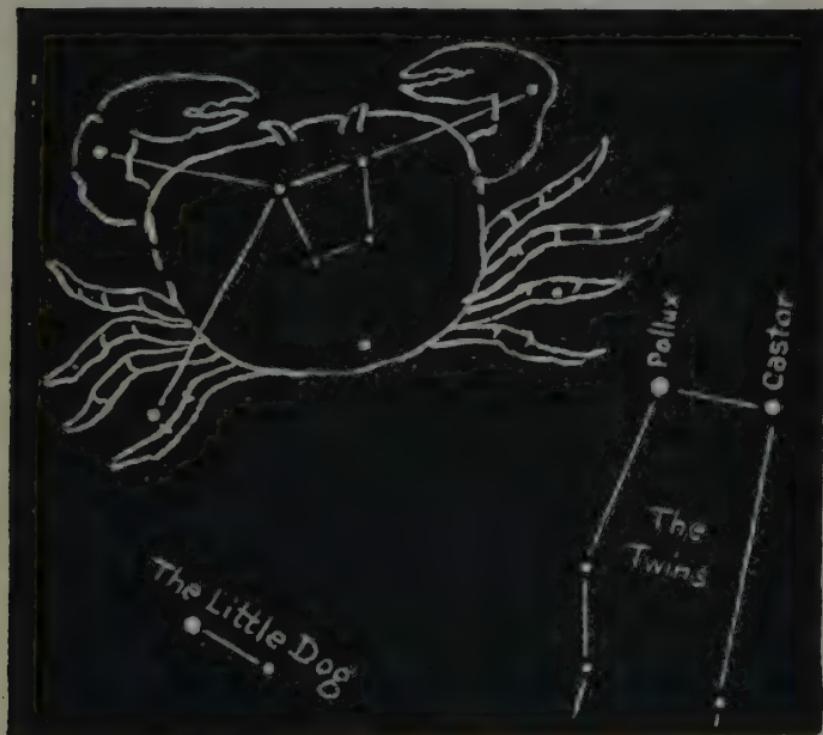
"Now that we've found the two dogs, that makes it easy to find *Cancer* the Crab," said Uncle Henry.

"Just draw a line from *Sirius*, in the Big Dog, through the Little Dog, and extend it almost as far again. (27) That's right. Now what do you see?"

The children searched the sky for some time, and Betty finally said, "Sort of a sprawly bunch of six or eight rather faint stars."

"Make little chalk-dots for them, then, Betty, and we'll try our best to make them look like a crab."

This shows how *Cancer* the crab looked when he was finished on the blackboard, and how he crawls in the sky away from *Canis Major* and *Gemini*, the twin boys. Perhaps he has learned by experience to leave boys and dogs as far behind as possible.

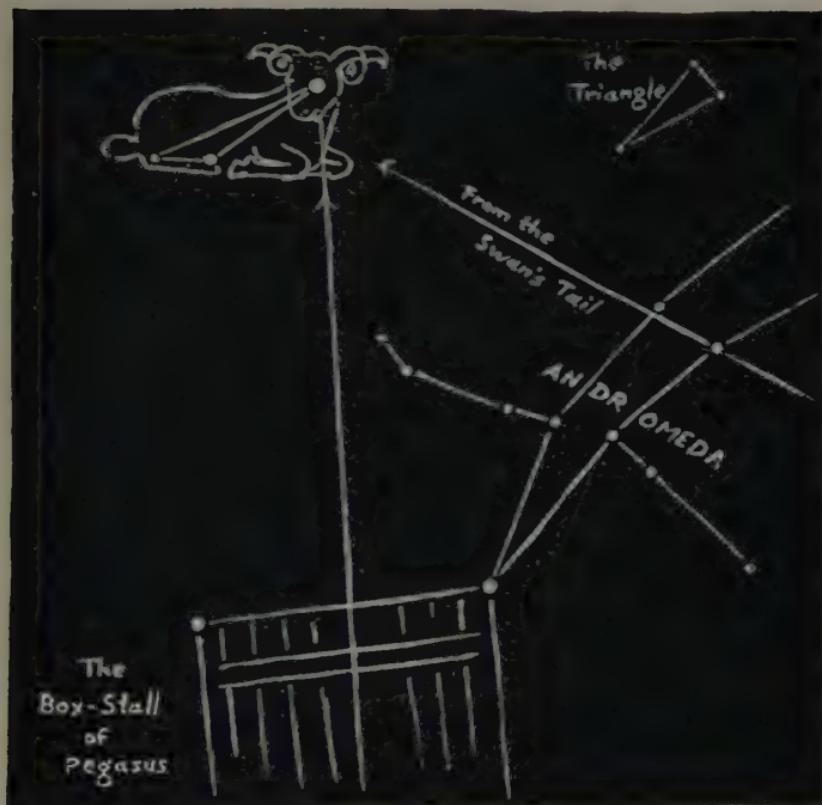


"Now let's find the ram!" said Paul. "I want to draw him."

"The ram," said Uncle Henry, "is very small, and is made of only three stars. A line drawn from the top corner of *Pegasus*' box stall, on the side next the pole, going straight down the side, and extended below it one and a half times the height of the stall, will point to the ram. (28) You can also locate *Aries*, the Ram, by drawing a line from the star in the swan's tail, across the stars in *Andromeda*'s hips, and beyond them a little more than the distance from her head to her hips. Don't mistake a little triangle of stars that you will see just below *Andromeda*'s left leg for the three stars of *Aries*. *Aries* is a triangle, also, but it has *two* fairly bright stars, while the triangle has only *one*. Do you all see *Aries*, the Ram?"

The children had all found it after a few moments, as well as the triangle under *Andromeda*'s feet. When Paul had made the chalk dots and lines for *Aries*' skeleton, Uncle Henry drew the outline around them and the ram looked like this. You will see that in order to show *Aries* right side up, the blackboard had to be turned so that *Andromeda* was upside down.

"While we are in the neighborhood of *Pegasus* and *Andromeda* and *Aries* the Ram we may as well find the two fishes. One of them, called the *Northern Fish*, lies just about halfway between *Andromeda*'s body and *Aries*—and the other, called the *Western Fish*, lies just back of *Pegasus*' box stall, quite close to the water jar of *Aquarius*. (29)



“The two fishes are tied together by their tails. The cord or ribbon runs eastward from the tail of the *Western Fish*, running about parallel to the side of *Pegasus*’ stall, and then makes a sharp angle, coming back toward *Andromeda*, where it is fastened to the *Northern Fish*’ tail.”

When *Pisces*, or “The Fishes” were found and drawn with chalk they were in this relation to *Pegasus*, *Andromeda*, *Aries*, and *Aquarius*’ Jar.



"While I think of it," said Uncle Henry, "I want to tell you that sometimes you may find a very bright star in a constellation where it doesn't seem to belong. If you watch it for a few nights you will see that it moves. It isn't a star at all, but a *planet* or "wanderer." Sometime I'll show you how to know all the planets by sight and name. You will never see them except in the zodiac constellations, so they need not confuse you. And now I think all of us had better go downstairs and get warm before we go to bed. Besides, we want to leave a little to do to-morrow night, and there are only two constellations left now."

"Only two?" cried the children in disappointment.

"Only two that we can see well," assured Uncle Henry.

"Well," said Peter, "I guess we'd better have the Society adjourn. I move we adjourn."

"Second the motion," said Paul, with true parliamentary solemnity.

"Carried," murmured Betty, who was beginning to get sleepy in spite of herself.

THIRD WINTER EVENING

THE SKY CLOUDED OVER, BUT PETER FOUND THE STAR PEOPLE HIDING IN THE ALMANAC—PAUL FOUND HIS HEAD WAS THE WORLD—AND THE “SOCIETY” FOUND OUT ABOUT THE SWASTIKA AND THE ZODIAC, AND HOW YOU TELL WHEN A DIPPER IS A PLOUGH AND WHEN IT’S A WAGON

NEXT evening Peter and Paul carried the blackboard to the roof after supper, but soon returned in disappointment. The sky had all clouded over! The evening’s session of the “Society of Star-Gazers” was spoiled. Its members stood in a circle about Uncle Henry and looked hopefully at him. Never yet had he failed to make good in an emergency.

“Well, it can’t be helped,” said Uncle Henry cheerfully. “We’ll just have to bring Starland down here into our playroom for this evening. Suppose you get me—let’s see—about a dozen sheets of paper from a big scratch pad, some of Betty’s colored crayons—they had better be the dark-colored ones—and a good-sized sheet of stiff cardboard or Bristol board. Yes, and some pins and an Almanac. Betty’ll get the colored pencils, Paul the cardboard, and Peter the sheets of paper and the pins. I’ll borrow the Almanac from Katy. She has one in the kitchen.”

The children scattered for the materials and Uncle

Henry took the shade off the electric lamp that stood on the playroom table.

When everybody was back in the playroom with the things needed the Society gathered around Uncle Henry and asked,

“Where do we go from here, Uncle Hen?”

“Out into Starland,” said Uncle Henry, spreading out his arms wide. “This room is the universe. This lamp with the shade off is the sun. Imagine that the pictures on the walls are groups of stars, the constellations, the star-people we have been finding in the sky right along. Imagine that there are pictures on the ceiling, too, and on the floor. Lots of them, all over the six sides of this square room.

“Now Paul, you have a nice round head and have just had a hair-cut. Your head can be the earth. Just walk around the table once or twice until we get used to thinking about your head as the world. It seems rather small at first. That’s right. Now you’re going around the sun the way the earth does, from right to left, just opposite to the way the clock-hands go. You go once around the sun every year.”

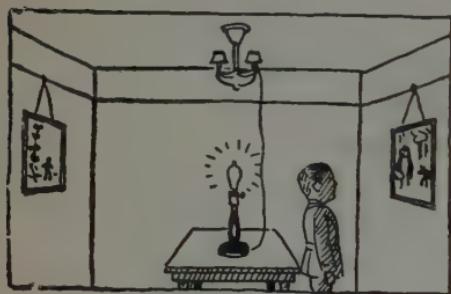
“The earth of course spins on its axis, too, just like a top, while it is circling round the sun. It turns round completely every twenty-four hours, from West to East. Paul, see if you can spin like a top while you are going round the lamp. Spin from right to left, just opposite to the way the clock-hands go.”

Paul did his best to spin and walk at the same time, and Uncle Henry showed Peter and Betty that the side of Paul’s head that was toward the lamp was

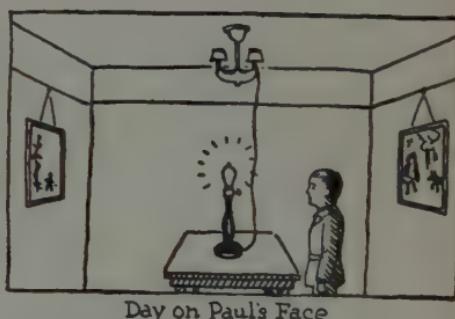
always bright, while the other side was always in shadow. As Paul turned on his axis from right to left his face became lighted, then the right side of his head, then its back, then the left side, and so on, round and round.

Part of the time Paul was facing a picture on one wall and the next minute his back was toward that picture and he was looking at another picture on the opposite wall, across the lamp.

These two drawings show how Paul faced the two pictures one after the other.



Night on Paul's Face



Day on Paul's Face

“Now tell me,” commanded Uncle Henry, “which picture you see the plainest—is it the one you see when your back is to the lamp—or is it the one you see when you face the lamp, and look across it toward the picture on the wall beyond?”

“The lamp is so bright without a shade that it blinds me when I try to see the picture beyond it,” said Paul.

“Oh, I see! I see!” said Betty, beginning to hop up and down. “Can I tell, Uncle Henry?”

"Surely," laughed Uncle Henry, "what do you see?"

"When Paul faces the picture with his back to the lamp," said Betty, "it's night on his face, and day on the back of his head! Is that right?"

"Yes, go on," encouraged Uncle Henry.

"And so he can see that picture better, 'cause the lamplight isn't in his eyes. But when he faces the lamp and looks across it, then it's day in his face, and night on the back of his head, and he can't see the picture beyond the lamp very well, 'cause the sun-lamp shines in his eyes."

"So that's why we can only see the stars at night!" said Peter.

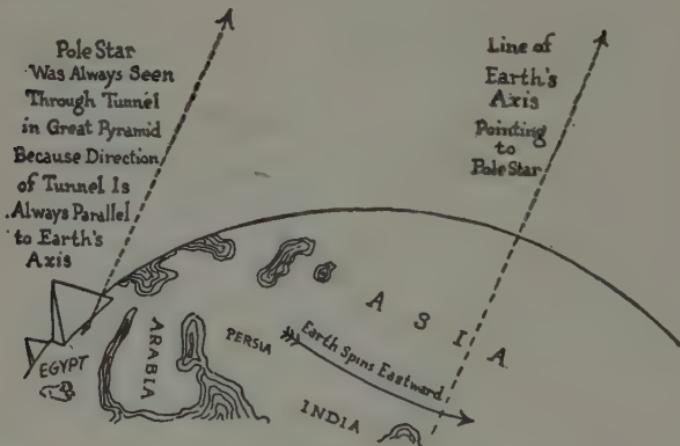
"Yes, that's why the moon and the stars come out only when it gets dark," said Uncle Henry. "You see the earth turns round and carries us to its dark side, the side that is away from the sun. We say 'The sun has set.' Then when the sun glare is gone from our eyes we can see the sky-pictures, just as Paul sees one picture better with his back to the lamp than he does the other when he has to look through the lamp-light toward it."

"And the stars are in the sky all day long, whether we see them or not?" asked Paul.

"Certainly," said Uncle Henry. "If you could look up at the sky from the bottom of a very deep well, or a tall chimney, so that the sun-light was kept out of your eyes, you could see the stars shining in the daytime. There is a long deep tunnel in the great pyramid of Egypt that goes up and out from

the centre of its base toward its north side at just the right angle so that the ancient Egyptians could always see the pole star through it—no matter whether it was night or daytime. You see the pole star never rises or sets, because it is always right over the end of the axis that the earth spins on."

This picture shows how the tunnel in the great pyramid always pointed to the north star because the tunnel is always parallel to the axis the earth spins on.



When the pyramid was built, the star in the tip of the little bear's tail was not the pole star, as it is now. At that time the star that was nearest the pole was one of those in the dragon. Since the pole of the earth goes round in a complete circle among the stars every 25,000 years, the star in *Draco* will some time be the pole-star again—in, say 20,000 more years!

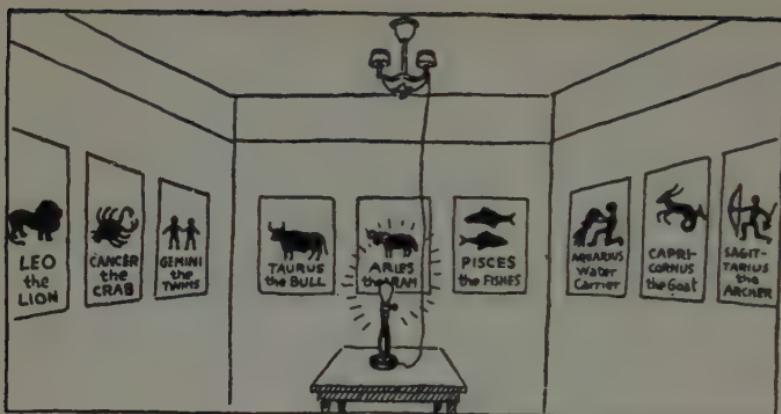
Peter had picked up the Almanac that Uncle Henry had borrowed from Katy and suddenly cried,

"Oh, Uncle Henry, the Almanac has a lot of the Star People in it. It calls them 'The Signs of the Zodiac.' What's the Zodiac, Uncle Hen?"

"We are going to find out right away, Pete," said Uncle Henry, "but first we must draw pictures of the twelve star folks that are the Zodiac signs. That means three drawings apiece. Pull up your chairs to the table and we'll draw on the sheets of scratch paper with Betty's colored pencils. Paul, you do the *Virgo*, *Leo*, and *Cancer* the Crab; Peter will draw *Gemini* the Twins, *Taurus* the Bull, and *Aries* the Ram; Betty will do the Fishes, called *Pisces* in Latin, *Aquarius* the Water Carrier, and *Capricornus* the Goat; while I will draw *Sagittarius* the Archer, *Scorpio*, and *Libra* the Balance. All old friends of ours."

"We'll put the Almanac here in the middle of the table where we can all see it while we copy the 'signs,' one on each sheet of paper."

Everybody was very busy indeed for about half an hour. At the end of that time the twelve rough drawings were done and pinned up at equal distances apart around the walls of the playroom, three on each of the four walls. They were arranged around the room in the same order in which Uncle Henry had assigned them. The room then looked like this, though of course you see only three walls in a picture. You must imagine how the fourth wall looked.

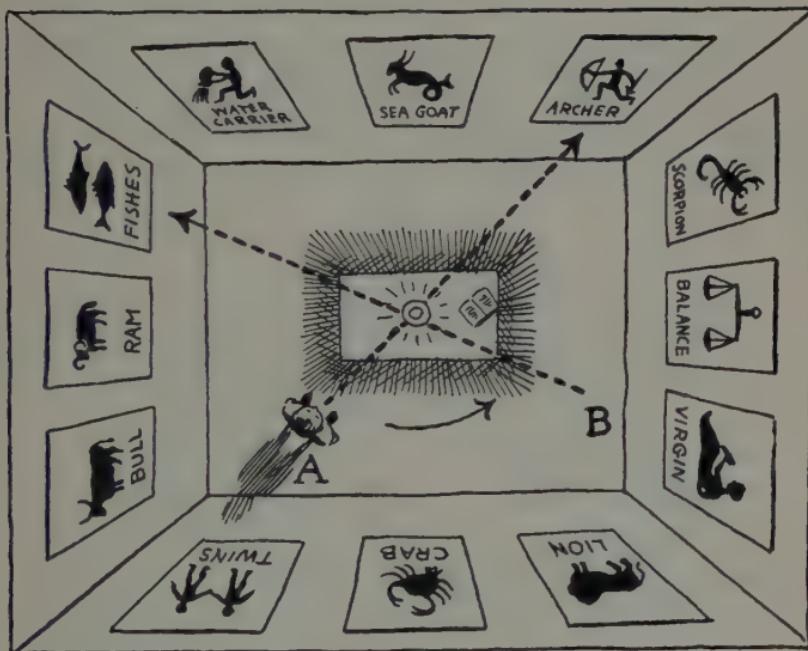


"Now Paul, suppose you walk around the table again, spinning on your own axis as you go, and we'll try to find out what the Zodiac is. You notice that the pictures are all pinned on the walls at the same height from the floor, which is just the height of the electric lamp bulb, and just the height of Paul's head too, no matter where he is in his walk around the lamp. The twelve constellations, or signs of the Zodiac are in the real sky also on the same level with the earth and the sun, no matter where the earth is in its journey round the sun. Astronomers say it this way: they say that the earth revolves around the sun 'in the plane of the ecliptic.' That simply means that if the sun was in the centre of an enormous horizontal pane of glass, the earth and all the signs of the Zodiac would also always be touching the pane of glass, which would then represent the 'plane of the ecliptic.' Put an *l* in 'pane' and you have 'plane.'"

"Is each sign for a month?" asked Peter. "I see there are twelve of them."

"That's correct," said Uncle Henry, "and you want to notice that as Paul walks round the lamp and looks across it at the signs on the wall beyond it, the lamp seems to Paul to move from one picture to the next."

This picture is drawn as if the ceiling of the room was taken off and you could look down on Paul walking around the lamp.



When it is January first, Paul, representing the earth, is in the position marked A, nearest to the picture of *Gemini* behind him, while the lamp, representing the sun, appears to him to be entering the sign of the Zodiac called *Sagittarius*, directly opposite across the room. Later, on April first,

after three months, Paul, or the earth, has traveled a quarter of the way around the sun, has passed the pictures of *Cancer* and *Leo* on the wall behind him, and stands nearest *Virgo* in the position marked B. The lamp has also seemed to move through a quarter circle, has passed through the signs of *Capricornus* and *Aquarius*, and appears to Paul to be just entering the sign of *Pisces*, or the Fishes. In the same way the earth moves through a sign of the Zodiac every month and the sun, while really motionless, *appears* to also travel through a sign every month. Of course we cannot see the sign or constellation, where the sun appears to be, at the



same time we see the sun, for his brightness makes the stars invisible, but if we *could* see the constellations by day, the sun would appear to travel from one sign of the Zodiac to the next every month."

Here is a clock of the year which shows the earth at one end of the hand, the sun in the middle, and at the other end of the hand an arrow, which points to the sign of the Zodiac where the sun appears to be, and to the date when it seems to be there to an observer on the earth. Draw the hand with the earth-end in several different positions and you will see that the sun, if viewed from the earth, would appear to be in the sign of the Zodiac exactly opposite.

When the children all understood the way the Zodiac divides the yearly path of the earth into twelve equal parts, Betty said, "I want to know why the geography globe at school always looks just as if it was going to tip over."

Uncle Henry laughed. "If you think the geography globe looks unsteady because its axis of iron rod is on a slant, what will you think about the earth when I tell you that it spins around in just the same slanting position, with only an *imaginary* line for axis?"

"Does it really?" asked Betty.

"Yes," said Uncle Henry, "and it spins so steadily in that slanting position that the north end of its imaginary axis always points toward the same place, a point very close to the north star, or *Polaris* as it is called."

"*Polaris* is named for the North Pole, I suppose," said Peter.

"That's right," Uncle Henry replied. "Let's get some scissors and we'll use our big sheet of cardboard to make a cap for Paul's head that will show you just how the slant of the earth's axis makes it hotter in summer and colder in winter."

"Ooh!" exclaimed Paul, "I always thought it was hot in summer because the earth got nearer to the sun then."

"Lots of people think that, too," said Uncle Henry, "but it isn't so. The earth is really farther from the sun in summer."

Betty ran for the scissors, and Uncle Henry cut out a big circle from the stiff cardboard. Then he cut out an opening in the centre of it that fitted Paul's head just as a stiff straw hat would that was a size too big for him. The circle of cardboard dropped down until it rested on Paul's ears and on the bridge of his nose. This cardboard brim represented the "plane of the earth's equator," just as the pane of glass represented the "plane of the ecliptic." Since the "plane of the equator" is always at right angles to the slanting axis of the earth, the "plane of the equator" is always at a slant to the "plane of the ecliptic."

If you will run a long hat-pin through an orange, and sink the orange exactly to its middle in a glass bowl filled with water, holding the hat-pin at a slant, you will see that the equator of the orange is at a slant with the surface of the water. Half of the

orange's equator curves up above the water, while half of it curves down under the water's surface. If you fasten a cardboard ring around the orange at the equator the cardboard will then be at an angle with the surface of the water, which represents the "plane of the ecliptic."

Uncle Henry cut two long strips from what was left of the cardboard and crossed the strips over the top of Paul's head, fastening the four ends of them to the round cardboard brim close to his head.

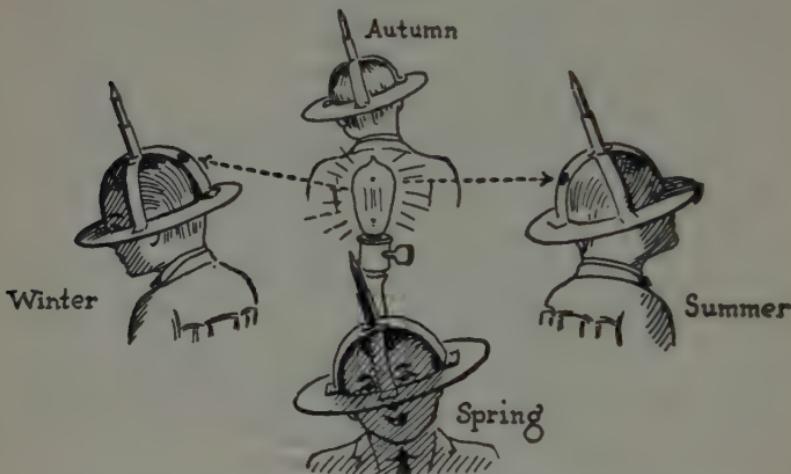
After this Uncle Henry rolled a sheet of the scratch paper round a pencil, put rubber bands tightly around it, cut the end to bend up and make a foot and pinned the foot to the cardboard strips at the place where they crossed. When Paul had it all on he looked very funny with the pencil sticking straight up from the top of his head, and his eyes just peeping over the card board brim on each side of the strip down the middle of his nose.

"Now come on, Mr. Earth," said Uncle Henry, "It's time for you to spin round the lamp-sun for another year or two."

So Paul held his head on a slant and kept it so that the pencil always pointed in the same direction as



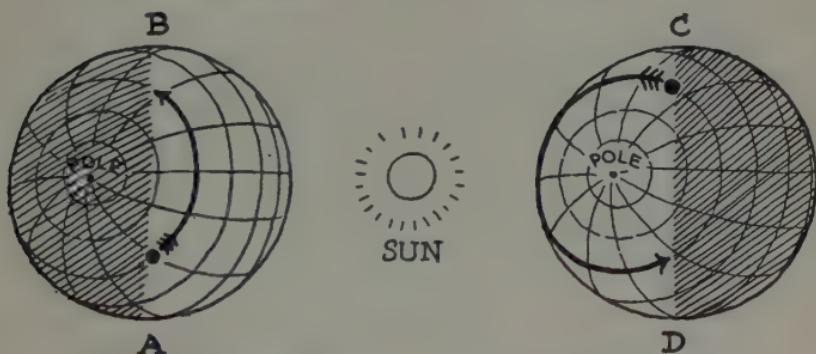
he went round the lamp. These four little pictures show how he looked at the four sides of the sun where the earth is in Winter, Spring, Summer, and Autumn.



"Now," said Uncle Henry, "you see that if we make a black dot on one of the cardboard strips about halfway between the cardboard brim, or the earth's equator, and the pencil, or the North Pole, it will be about as far north as we are in the United States. And when Paul is in his Summer position, with the pencil slanting *toward* the 'sun,' you see that the sun's rays beat down much straighter on the black dot than they do when he is on the other side of the lamp, with the pole slanting *away* from the 'sun.' That is why the Winter sun appears to be lower in the sky at noon than the Summer sun, and also why the Summer sun shines hotter on the earth than it does in Winter. Notice, too, that the rays from the lamp light up Paul's head for quite a little

way beyond the foot of the 'pole' when it slants *toward* the 'sun,' while when it slants *away* from the 'sun' the rays fail to reach the 'pole' at all. This means that in summer the sun shines a longer time upon the part of the earth that slants toward it. If you could look down from the ceiling at Paul's head in his Summer position and in his Winter one you would see why."

Uncle Henry quickly drew these two pictures of the top of a globe to show the children why the days are long in Summer and short in Winter at any point in the United States.



The Winter Day

lasts while the black dot on the earth travels from A to B—less than half-way round.

The Summer Day

lasts while the black dot on the earth travels from C to D—more than half-way round.

"It's just like the hot water bottle mother kept in my bed that time I had a chill after swimming," said Paul. "The hotter it was before she put it in the bed the slower it cooled off."

"That's the idea," said Uncle Henry, "the longer the sun shines on any place on the earth the hotter

it gets, and when the nights are as short as they are in Summer the place hasn't long to cool off before it is round in the sun's hot rays again. Now do you see why Summer is hotter than Winter?"

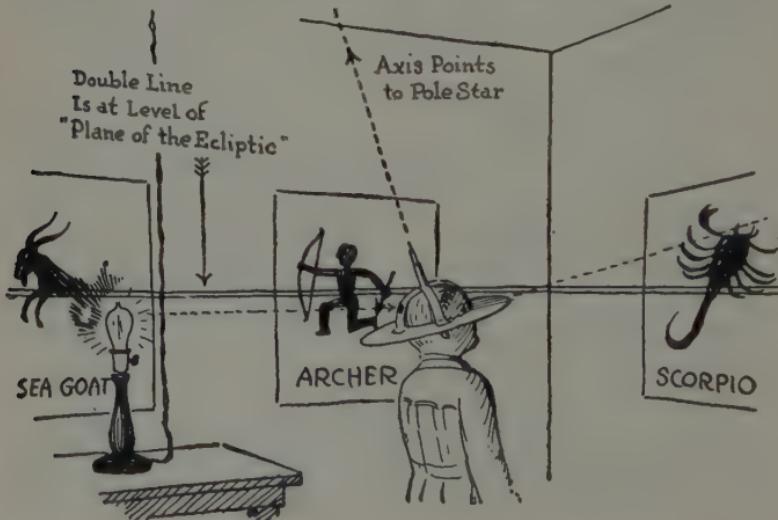
The children did.

"There's one thing I don't understand, though," said Peter. "Why are there different stars in the sky in Winter than there are in Summer?"

"That's easy to answer," said Uncle Henry. "Look at Paul again—first when it's 'night' on his face on the 'Summer' side of the lamp, and then when it is 'night' on his face on the 'Winter' side of the lamp.

"At 'night' in Summer Paul looks at the pictures on one end of the room. The cardboard brim, or 'plane of the equator,' is slanted *up*, above the 'plane of the ecliptic.'"

This picture shows how Paul looked.



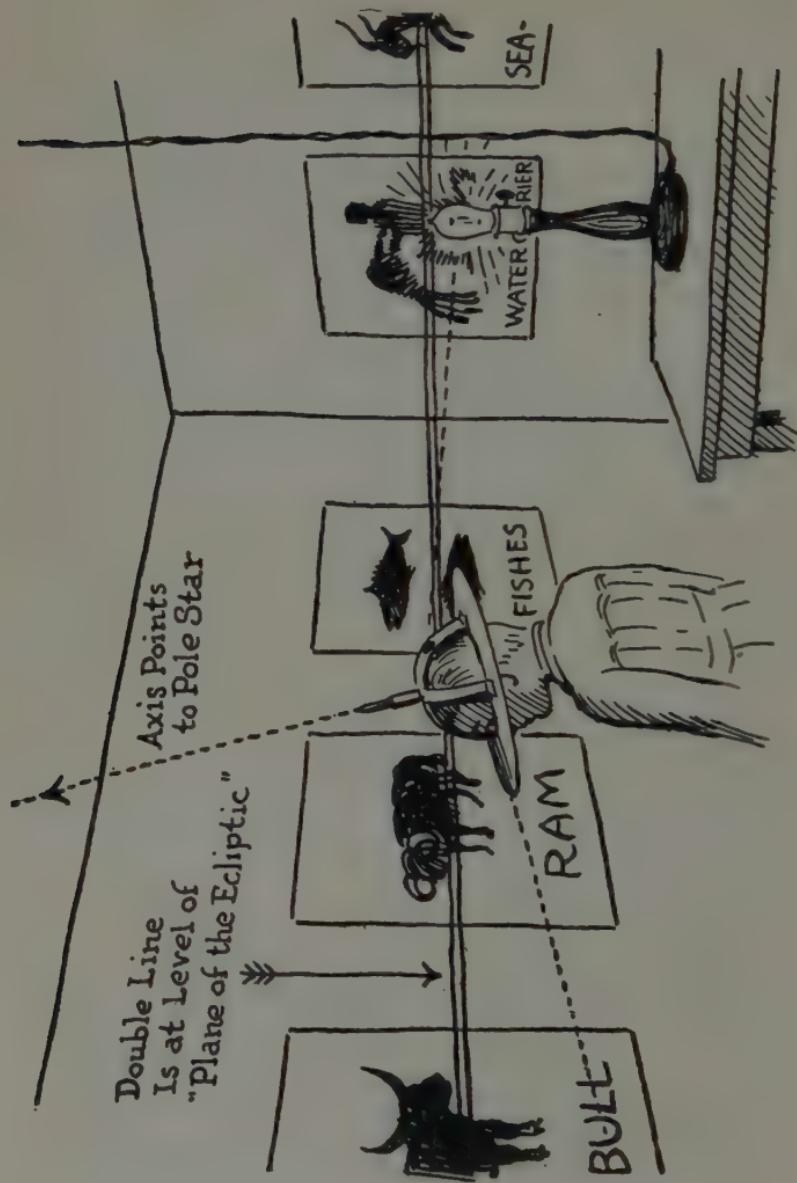
"But in Winter, at 'night,' Paul looks at quite different pictures, at the other end of the room. The cardboard brim is slanted *down*, below the level of the 'plane of the ecliptic.' This is why the path of the Winter Signs crosses the sky higher up than the path of the Summer Signs. In both Winter and Summer you must imagine the cardboard brim to be as transparent as glass, for the 'plane of the equator' is in reality only imaginary."

This next picture shows how Paul looked at the constellations at "night" in Winter.

"Of course the north star and the stars for a considerable distance round the pole never set, and can be seen all night at any time of the year. It is only the ones that rise and set that go and come from our sight with the seasons. In reality they never leave us, for if it wasn't for the sunlight getting in our eyes by day, we could see the Summer night star-pictures in the Winter daytime, and the Winter night star people in the Summer daytime. We are just looking at opposite ends of our big room in the universe on Winter nights and Summer nights, that's all," said Uncle Henry.

Uncle Henry took some folded papers from his pocket and spread them out on the table.

"Here are four maps of the sky," he said, "which show the way it looks at different seasons at 9 o'clock in the evening—on January 1st, April 1st, July 1st, and October 1st. You will see that the groups of stars around the pole are always in view, while the rest of the star people change with the seasons, but



even the groups around the pole change their positions with the seasons.

"You have all seen the *Swastika*. It has been known and used as an ornament for hundreds of years, all over the world—by the American Indians, the Chinese, the East Indians, and many others. I'll show you where I think all these widely separated people got the *Swastika*, and how it stands for the four seasons."

Uncle Henry drew four little pictures showing the four positions in which the big dipper stands in the four different seasons, with its "pointer stars" always indicating the pole star.



At the right of the pole star in Winter.



Above the pole star in Spring.



At the left of the pole star in Summer.



Below the pole star in Autumn.

Then he drew all four positions on one sheet of paper, like this:



And when heavy lines were drawn along the handles of the dippers and across the pole star from bowl to bowl the *Swastika* suddenly appeared like this:



The Society of Star-Gazers was very enthusiastic about the origin of the *Swastika*, and found the dipper in its different positions on all of the four maps that Uncle Henry had put on the table.

You can see the position of the dipper and all the other stars at January 1st, April 1st, July 1st, and December 1st, at 9 o'clock in the evening, by looking at the four maps inside the covers of this book.

After the children had looked at all the four maps as long as they wanted to, Uncle Henry suddenly remembered to look at his watch and exclaimed,

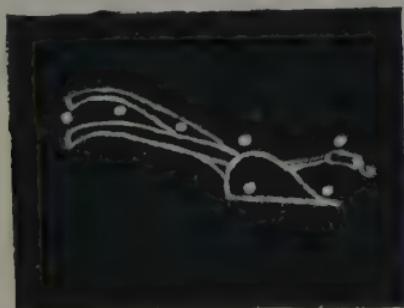
“My goodness! I guess it’s about time the Society adjourned for to-night. Ten o’clock! I’ll get scolded for keeping you up so late.”

“I want to ask just one thing more,” pleaded Betty.

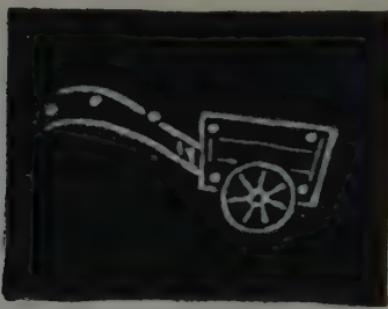
“All right, what is it?” said Uncle Henry.

“Who found all the sky people?”

“Well,” said Uncle Henry, “now that’s a long story. They were all found and named so long ago that nobody knows who did it. The inventors of the star people naturally thought they saw pictures in the sky of the things they were familiar with in everyday life—the bear, the bull, the serpent, the archer, and so on. If they had had any steam engines then somebody would have drawn lines from star to star until they had a picture of one in the sky. In England the Great Bear or Dipper is usually called the ‘Plough’ and you can see why



"It is also called 'Charles' Wain' or wagon.



"We only know that the constellations are very, very old, and that an ancient people living in the valley of the Euphrates river probably named most of them. The Babylonian Tablets, the oldest records known, show that the Zodiac constellations were known over 3000 years before the birth of Christ, which is now nearly 5000 years ago."

"Can't we have just one more poem before we go to bed?" said Paul.

"Yes," said Uncle Henry, "but not one of mine. I'll give you a little bit of a long poem that was written by a man named *Aratos* about 280 years before the wise men followed the star that told them where to find the new-born Christ. It has been running through my mind all the evening. This is it:

"And all the signs through which Night whirls her car,
From belted *Orion* back to *Orion* and his dauntless Hound,
And all *Poseidon*'s, all high *Zeus*'s stars,
Bear on their beams true messages to man."

FOURTH WINTER EVENING

IN WHICH THE "SOCIETY" MEETS THE LAST OF THE STAR PEOPLE AND THE BEGINNING OF ASTRONOMY—
AND BETTY PROPOSES A "NOTE" OF THANKS

THE Society of Star-Gazers assembled upon the roof the next night with an eagerness that was tempered a little by regret that it *was* the last.

Uncle Henry saw this, and before starting to find the evening's constellations with the children, told them a few of the many wonderful things to be seen among the stars with the aid of a small telescope.

He reminded them of the "little cloud" in *Andromeda*, called the Great Nebula, and said that there were not only many more of these wonderful clouds of star dust, but numbers of beautiful double stars, some of them lovely with tints of red, green or orange, and some that can be seen with an ordinary opera-glass.

Then he told them of the curious variable, or "winking" stars, which turn bright and faint alternately on a regular schedule, so many hours bright, and so many hours faint. Also he described the beauty of the planet *Jupiter*, surrounded by its four little moons, all of which could be seen with a small telescope.

Then the children began to feel more cheerful,

for they saw that being introduced to the creatures and people of Skyland was only the beginning of the study of astronomy.

“So,” finished Uncle Henry, “we don’t need to feel that there is no more fun coming, for there are lots more faint constellations which are all beautiful, even though not plain enough for us to find easily in the beginning. Besides, if you ever journey to the South, beyond the earth’s equator, you will find a whole new sky full of marvelous people, and creatures, and objects—all pictured in the flashing southern heavens.”

“Well,” said Peter briskly, “what do we find to-night, Uncle Hen?”

“We’ll begin,” replied Uncle Henry, “with a person you may have heard of—*Perseus*, who killed the terrible Gorgon *Medusa*.”

“Oh, I know him,” cried Paul, “we read all ‘bout him last year.”

“Quite right,” said Uncle Henry, “then you remember that when he had killed *Medusa*, and cut off her head with his sword, he had to hold the head with the terrible face away from him, because everybody who looked at that face was instantly turned to stone.”

“Yes, yes, we know!” chorused the Society.

“Well, now we’ll find *Perseus*, his sword, and the head of *Medusa*,” promised Uncle Henry. “All you have to do is to extend the line of *Andromeda*’s left leg and prolong it from her foot, straight out for about her whole length. (30) There you will find

Algenib, the brightest star in *Perseus*. It is right in his neck, between his shoulders. From *Algenib* you can trace a row of stars downward, almost to the *Pleiades* in the bull's shoulder. This row of stars is *Perseus'* body and legs. Then find two stars above *Algenib*, one over the other, and you have his head and helmet.

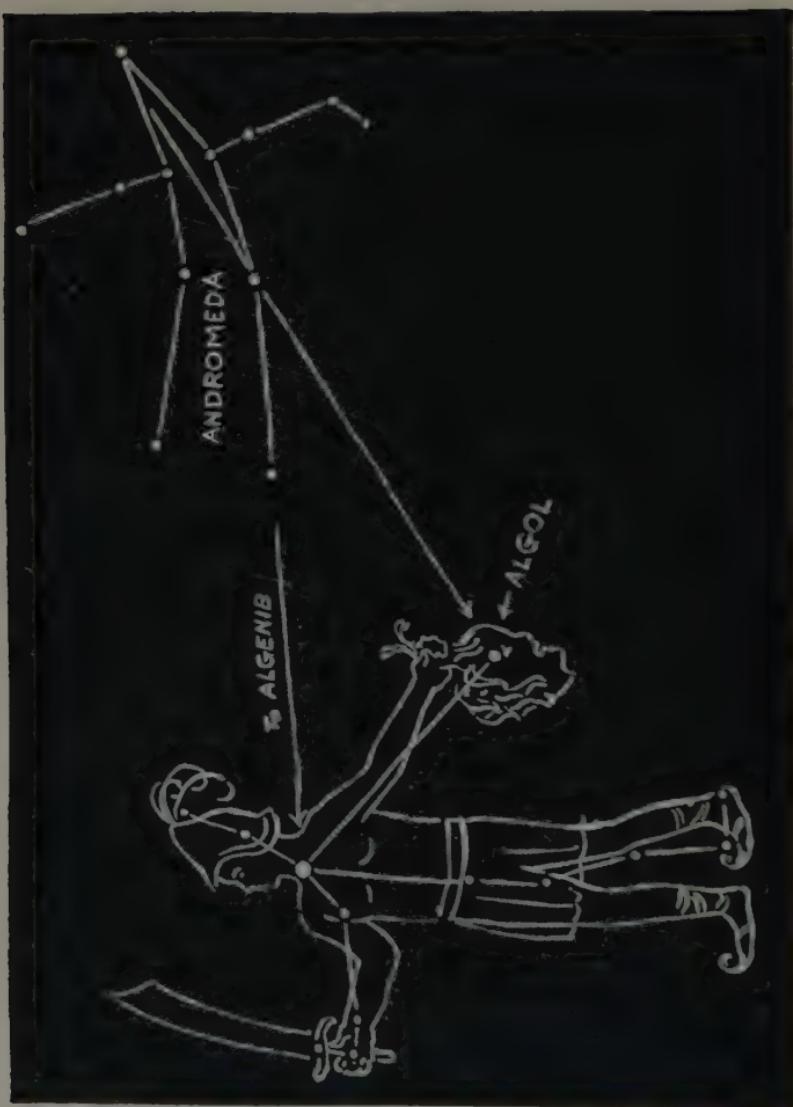
"After that it is easy to start at *Algenib* and trace out his right arm, with the sword. A line drawn toward *Perseus* through the stars in *Andromeda*'s head and left hip points out the star *Algol*, which is the head of *Medusa*, held in *Perseus'* left hand. (31) *Algol* is a famous variable star, which the ancients named 'the dragon of the slowly winking eye.'"

The children soon found all of *Perseus*, and all took part in drawing his skeleton on the blackboard. Then they watched *Algol* in the sky, and expected to see it wink, until Uncle Henry told them that the wink is so slow that it takes seven hours for *Algol* to become faint and bright again, and that then two and three-quarter days pass before *Algol* winks again. This being the case the Society decided not to wait, and finished *Perseus* up so that he looked this way:

Uncle Henry added the lines with arrows to show how *Algenib* and *Algol* are found, with the help of *Andromeda*.

"After *Perseus* was finished, Betty kept gazing at the sky. She seemed fascinated, and finally asked,

"Uncle Henry, there's a perfectly lovely star just a little way in front of *Perseus*, and three little ones



near it. If I could name stars I would call them 'the hen and chickens,' wouldn't you?"

All the children looked, and easily found the beautiful star. They couldn't have missed it, and neither can you, for it is one of the most brilliant in the sky and there are no others like it nearby.

"Yes," said Uncle Henry, "the big star and the three little ones do look like a hen and her chickens. I would call them that, too, Betty, but hundreds of years ago somebody named the bright star *Capella*, which means 'the goat,' and called the three little stars 'the kids,' so you see that they are named already."

"A kid is the baby of a goat, isn't it, Uncle Hen?" inquired Peter.

"Yes, that's the idea," said Uncle Henry, and went on, "Betty happens to have picked out the brightest star in the last constellation we are going to find. It is called *Auriga*, or the Charioteer. He hasn't his chariot with him."

"How do we find *Auriga*?" inquired Paul.

"He is very plain, almost as plain as *Orion* himself," said Uncle Henry. "*Capella* is at one corner of a five-sided figure, called a 'pentagon.' (32) It is also in the left shoulder of *Auriga*. Find the tip of the left horn of *Taurus*, the Bull, and you will have another corner of the pentagon, and at the same time the right foot of *Auriga*. When you have those points it is easy to find the other three corners, which are the right shoulder, left foot, and the right hand of *Auriga*. He holds his whip in that hand."

Even though he had to leave his chariot when he went into the sky, he insisted on taking his whip along. It comes in very handy, too, sometimes, when the two lions up there become fretful and uneasy. When you have found *Auriga*'s shoulder stars, just draw two lines upward to a star above and between them and you finish the charioteer's skeleton. The star at the point where the lines cross is in his head. See him, everybody?"

The children had no trouble in putting in the stars and drawing the skeleton. Neither will you, for *Auriga* is very conspicuous, and almost straight overhead in the evening about Christmas time.

This is the way *Auriga* looked on the blackboard:

When the children had finished looking at *Auriga*, and *Capella* the Goat and her three babies, Betty drew herself up very straight and said, trying to look very dignified,

"Mr. Chairman, I move that The Society of Star-Gazers give Uncle Henry a note of thanks for giving us such an instructive, and—and—oh, we've liked your Christmas present an awful lot, Uncle Henry!"

Peter was going to say that it was a *vote* of thanks that people got from societies, but Betty was so earnest and dignified that he didn't really want to take her down just then, so he joined Paul in seconding the motion and was appointed by Betty as a committee of one to write the "note" and deliver it to Uncle Henry later.

Uncle Henry looked quite serious, for him, and said that he had made up a little poem that they



might like to hear while standing under the Christmas stars.

The Society voted unanimously in the affirmative, so Uncle Henry recited,

“There was once a star of old,
Wonders to three wise men told.

Where it led, there followed they—
Stars had taught them how to pray,
How to know the Truth from lies—
God had taught them through His skies.

Where the star led, followed they,
Found the Christ-child, laid in hay—
To His mother, in the stable,
Brought Him gifts that they were able.

Stars lead us to Christmas Truth—
Let us look, with eyes of youth!”

Then, in a moment more, Uncle Henry and the children were gone, and the sleepless, faithful stars were alone, brooding lovingly over their tiny baby brother, which we call the great world.

The author desires to express his indebtedness to the following books, which have given him many hours of enlightening pleasure while riding the star-gazing hobby:

A Field Book of the Stars	Olcott
Star Lore of all Ages	Olcott
The Heavens and Their Story	Mrs. Maunder
Astronomy	Jacoby
Astronomy from a Dipper	Clarke
New Astronomy	Todd
Astronomy	Lockyer

He also wishes to add his appreciation of the monthly pleasure given by "The Evening Sky Map," published by Leon Barritt.

THE SKY MOVIES

TO "SAINT ELIZABETH

WE tell children things in the clearest words at our command. They say the words back to us and we are satisfied that they have learned something. We think that because they have the words they have the idea. A little investigation will show that very often the words are all they have, the sounds, and nothing whatever of the idea.

So, whenever you teach a child something new, be sure to tie the stranger to an old familiar friend. If that does not seem possible, use pictures and drawings and illustrations until the child has a group of related ideas concerning this new idea. Then let him talk it back, making his meaning clear by word and gesture and drawing.

Beware the empty word!

ANGELO PATRI.

PROGRAM OF THE PLAY

FIRST REEL—

	PAGE
In which the children unexpectedly meet Mr. Puck in Grandfather's Stump Meadow—and Learn Why Fairy Rings are needed in the World.	1

SECOND REEL—

In which Grandfather and Grandmother give wrong answers to Puck's Riddle because they don't know the real one—and the hired man, Otto, steers the children right without knowing it.	9
--	---

THIRD REEL—

Why the Princess <i>Istar</i> loses and gains her jewelled robes—and more about the Optick Brothers and what they learned of Luna Moon.	20
--	----

“JACK AND JILL IN THE MOON”—

The monthly Sky Movie—photographed by the As- tronomers at Yerkes Observatory.	33
--	----

FOURTH REEL—

In which the children learn how to see thoughts—just like pictures—and how Monsieur Foucault proved that the world spins like a top.	65
---	----

FIFTH REEL—

In which Uncle Henry makes a funny kind of Sun-Dial —the children learn to tell time by the Big Dipper —and Paul's camera proves again that the world turns round every day	90
---	----

PROGRAM OF THE PLAY

SIXTH REEL—	PAGE
The children get acquainted with Old Sol's family— and find Venus, Mars, and the Earth growing in a Pea pod.....	123

SEVENTH REEL—

In which Betty finds out how much can be told with- out words—and we get better acquainted with Old Sol's children and grandchildren.....	147
---	-----

THE SKY MOVIES

FIRST REEL

IN WHICH THE CHILDREN UNEXPECTEDLY MEET MR. PUCK IN GRANDFATHER'S STUMP MEADOW—AND LEARN WHY FAIRY RINGS ARE NEEDED IN THE WORLD

In the twilight of that June evening when the Young Moon was a thin bent bow in the West, she looked across Grandfather's Woods and saw three children come out from the dusky trees. Then she watched them start across Grandfather's Stump Meadow toward the farm house, where a light was already shining in the kitchen window.

Peter and Paul, the twin boys, were ahead, and Betty, their sister, brought up the rear.

Suddenly the Young Moon saw the three stop, and, if her hearing is good, she may have heard their high-pitched exclamations of delighted surprise at what they saw.

“O, look!” cried Paul, “a reg’lar circus ring of toad-stools!”

“There’s ‘most a million!” exclaimed Peter, “at least, ‘most a hundred—or fifty!”

“Ooo! it’s a Fairy Ring!” breathed Betty in a loud stage-whisper, while she looked expectantly through

the gathering dusk for any of the Little People who might be about.

Not seeing any, however, she confided to Peter and Paul,

“Uncle Henry told me to watch for a Fairy Ring when we got up here at Grandpa’s. Uncle Henry says that if you stand in a Fairy Ring, and wish and wish, awful hard, to truly know all ‘bout everything that you want to know ‘bout, that you *will* know.”

“Humph!” said Peter, with the disdain of eleven years for the credulity of eight.

“Well, I guess Uncle Henry ought to know,” insisted Betty, “he says he used to do it—right up here at Grandpa’s—maybe in this very ring—and I guess *you* won’t dare to say, Mr. Peter, that Uncle Henry don’t know a lot—most likely a million times more ‘an *you* do!”

Under this heavy gust of woman’s logic Peter bent like a grass stem in the breeze.

“Well,” he countered, “if you believe all that’s true, why don’t you just step into this good old ring of toadstools right now—and wish hard to know something? An’ then we’ll *see* who’s right about it. Maybe Uncle Henry *is* right,” Peter finished, leaving a wide opening for his own escape, in case the toadstool ring proved to have magic powers after all.

“Sure,” agreed Paul, “think of something you wanna know, Betty, an’ then get in the ring an’ *wish* to know it, an’ then we’ll *see* if Uncle Henry is right. Mos’ likely he is,” Paul conceded in advance.

After a short pause he added impressively,
“He is *generally* sure of his facts.”

The others turned to Paul and looked at him so disapprovingly after this last remark that he knew they had detected his bold theft from Papa’s collection of favorite phrases.

“Go on, Betty,” urged Peter. “Wish to know something quick an’ step inside the ring! We can’t stay out here after it gets real dark, an’ you may not find out what you wish to know all at once.”

Betty looked across Grandfather’s Woods, toward the slim, brightening bow of the Young Lady Moon, and said,

“All right—I wish—I want to know—what makes the lovely Lady Moon grow bigger, full, and thin again every month.”

Then, while the twin boys held their breaths in half-scared expectancy, Betty stepped confidently into the wide, grassy, magic circle of dim white umbrellas, into the enchanted Fairy Ring, and stood—waiting in simple faith for her beloved Uncle Henry’s prophecy to be fulfilled.

The boys gazed silently for a full minute, looking first at Betty and then at the Young Lady Moon. Nothing happened. Then they heard Betty murmur,

“I’ve always wondered about you, Lady Moon—I’m wondering now—why you’re slim—and why you grow full—and why—”

She stopped, startled, half afraid, for from the edge of Grandfather’s Woods there came a sudden, soft whirring like the humming of bees in the apple

orchard in blossom time—and out of one of the dim, velvety spaces between the trees poured a glimmering swarm of fireflies.

Straight across the Stump Meadow toward the Fairy Ring they came—while the whirring grew louder, and the soft gleams grew brighter.

Three times round the heads of the bewildered children the swarm of fireflies flew—and three times they circled a low stump just inside the Fairy Ring—then back for Grandfather's Woods—like a flight of tiny illuminated aeroplanes.

The children were all gazing open-mouthed after them when they heard the merriest little laugh—and it seemed to come from almost under their feet!

Peter and Paul looked right and left, and turned round and looked, without seeing anything—but Betty clapped her hands and cried,

“Oh, I see him! In a green suit! On the stump, Peter! Look on the stump, Paul!”

Peter and Paul did, and rubbed their eyes and looked again, but not a thing could they see—except a pad of green moss in a damp hole in the flat top of the stump.

But in a moment they heard the merry, tinkling little laugh again and again—and after it a gasp for breath—as if the laugher's sides fairly ached with his explosion of merriment.

Then, between gasps, came words,

“Tell—tell yon naughty ones—tell Petrus and Paulus—to step in the Ring. They will see naught—

of me or truth—except in Wonder Ring. Step inside!—Step inside!”

Peter and Paul did—and as soon as they crossed the magic circle of ivory-white umbrellas they saw what Betty had said—a tiny elf-like man—all in a green suit—with long, green hose, and green shoes with long points.

His plump-cheeked, red face was seamed and wrinkled like a sound apple that dries and shrinks small, and his eyes were pale blue like a baby’s.

When he laughed, his mouth was as wide as his ears, but at other times it was as pursed and puckered as Grandfather’s tobacco pouch when the drawstrings are tight, and from his green hood strayed wisps of sun-bleached hair.

Betty’s first thought, after her surprise at seeing him at all, was a desire to have the little foot-high manlet for a doll.

“Ods me!” cried Puck, for it was he *himself*, none other, “they see *now*—aye, they see *now*! Ha, ha! Ha, ha, ha! Aye, but they are the naughty ones yon!”

“*Why* are they naughty, please, Mr.—Mr.—sir?” inquired Betty, after a moment’s hesitation.

“He, he, he! ha, ha, ha!” rattled the little green man’s wide-mouthed laugh. He sounded for all the world like a good-natured squirrel chattering from a tree. Then he puckered his tobacco-pouch lips and solemnly winked one sparkling blue eye at Paul and the other at Peter before he said mockingly,

"*Maybe Uncle Henry is right—Most likely he is—He is generally sure of his facts. Ha, ha, ha, ha!*"

"My, aren't we sassy for our size!" exclaimed Paul, half angry at the mockery.

"The Lady Luna Moon," stated Puck, capriciously changing the subject, as he looked over his shoulder toward the West, "has bought her ticket for China. It's a round-trip one though. She'll be back—with Columbus or Magellan—probably with both," he finished solemnly, quite as if he expected it to happen and wouldn't have been surprised to see Columbus right there in the Stump Meadow.

"I like you," said Betty impulsively, "but you certainly talk so—so—well, I mean—"

Betty had started to say something quite impolite, and didn't quite know how to finish.

"Ods me!" cried Puck, "first you stand in a Fairy Ring, and *wonder* about Lady Luna—and then think I'm daft when I come! I know well I'm not crazy—I'm the Answer—the Answer to your 'wondering'—the slave of every Fairy Wonder Ring in the wide world's meadows—I'm *The Joy of Finding Out Things*. I sat on Columbus' shoulder when he saw the New World's land; I took the first peep through his new telescope with Galileo; I watched with Edison, while his first electric light bulb glowed, then brightened and shone.

"*They* were all called crazy too, but they didn't care, for they had me—the Answer to their wonderings—*The Joy of Finding Out Something New.*"

"Please Mr.—ah—sir—" began Betty.

"Call me Puck—t'will do," said the little man in green.

"Please, then, Mr. Puck, did Mr. Edison stand in a Fairy Ring and ask to know about the electric light?"

"Certainly, whether he knew it or not!" cried Puck. "No answer ever comes to the wonderings of man or child—except in a Fairy Ring! That's why men who delight to walk much in the fields to think are the ones who so often find out marvellous new things. It's because—sooner or later—they walk into a Fairy Ring—a Wonder Ring—and the Answer to all their wondering comes to them there."

"Then tell *me*, please, Mr. Puck," said Betty, "what *I* wondered about—why the Lady Luna Moon is thin, and grows full, and thin again, all in one month."

"Oh, ho!" cried Puck, "the little lady wants to know all—like that."

He snapped his fingers, winked one blue eye and then the other, and went on,

"If you can tell *me*, little lady, only one thing I will ask you about Luna Moon, I will tell *you* all you desire to know of her."

"All right," said Betty, a little disappointed to find that she had to give answers as well as get them in Wonder Rings, "I'll *try* to tell you—if I know."

"Here it is," said Puck. "What does the Lady Luna Moon always hunt, with her bent bow?"

Betty thought and thought, and so did Peter and

Paul, while Puck sat cross-legged on his stump and whistled a strange old tune through his lips, pursed now like Grandfather's pouch.

At last Puck stood up, hopped down among the cowslips that splashed the soft sod with gold, and said,

"Tell me what it is the Lady Luna hunts—on tomorrow's eve—here in the Ring—and I will be here to tell you more. Petrus, bring a lantern; Paulus, thy fresh-shaved round head; little lady, the white ball thy dog runs after. To-morrow's eve—in the Ring."

Then Puck stepped across the edge of the mushroom ring and was gone. One second he was there, clad in green—and the next there was nothing there—except grass and cowslips.

"This sure is a Wonder Ring, all right!" cried Peter. "He makes us wonder *more*, instead of less."

"What *can* he want with a lantern—and 'Rags' ball, and my head?" mused Paul, as the children trudged toward the welcoming light in Grandmother's kitchen window.

Betty said nothing. She was thoughtfully watching Luna Moon's bent bow as it sank in the sky beyond Grandfather's Woods—after the vanished sun.

She was still trying to guess the answer to Puck's riddle when she fell asleep in the little room under the eaves, where the ceiling slanted just like the roof, and the big bed made it seem a long time until one would be really grown up.

SECOND REEL

IN WHICH GRANDFATHER AND GRANDMOTHER GIVE
WRONG ANSWERS TO PUCK'S RIDDLE BECAUSE THEY
DON'T KNOW THE REAL ONE—AND THE HIRED MAN,
OTTO, STEERS THE CHILDREN RIGHT WITHOUT
KNOWING IT

NEXT morning Betty and her brothers "interviewed" everybody on Grandpa's farm, and no one was permitted to escape until he had told all he knew about Luna Moon and her bent bow.

Betty began with Grandpa himself. The "committee of inquiry" raced out to the barn where he was cleaning a harness, and Betty walked up to him with an air of such serious purpose that Grandpa said, with an alarmed look on his face,

"I'm the man you're looking for, Miss Sheriff. I'm Captain Kidd, miss; you'll find the treasure chest of 'pieces of eight' buried under the third apple tree in the second row from the barn. Take it and spare my life. I'll never run up the 'Skull and Bones' at the mast head of a ship again, so help me Davy Jones!"

At this Betty laughed gleefully, and the boys took the harness away from Grandpa and made him sit down on the edge of the watering trough.

Then Betty said, quite as regally as good Queen Bess might have done to the real Captain Kidd, if they had happened to live at the same time, and if they had happened to be socially acquainted, and if Captain Kidd had happened to ask such a little favor of her, say while they were drinking tea together,

“All right, Captain, your life is spared—on one condition. We want to know what it is that the Lady Luna Moon always hunts and shoots arrows at with her bent bow. Tell me that, Captain Kidd, or you shall walk the plank and swing from a yard-arm.”

“Both? Then I’ll tell you all I know, Madam Sheriff,” said Grandpa seriously. “My grandpa told *me*, and he *knew*. You see it’s like this. When the young moon’s bow lies on its back, with the horns up, so that the old Indian Ossawatomie can hang his rifle and powder horn on them, it is going to be a *wet* month, and the old Indian Ossawatomie will stay home from hunting. But if the young crescent moon stands up on one horn, so that the rifle and powder horn would slip off, why it’s going to be a *dry* month and Ossawatomie will be able to go hunting. Now please, Miss Sheriff, I’d like to finish cleaning that harness.”

“I guess,” said Peter slowly, “that we’ll have to get that plank ready for Captain Kidd to walk after all.”

“Don’t you really know what Luna Moon shoots her arrows at?” asked Betty disappointedly.

Grandpa only shook his head slowly and sadly

and begged to be given until sunset to live, in order to go to town with a load of hay and play one more game of checkers on his return. So the "committee of inquiry" went in search of Grandma.

She was in the kitchen "stirring up a cake," but as soon as the oven door was closed upon it she walked over to the calendar on the kitchen wall and tried to answer Betty's question about Luna Moon.

"You see, dearie," said Grandma, "the moon looks like this when it's in the 'first quarter.'"

Grandma pointed to this picture of it on the calendar.



Then she pointed to the next moon-picture on the calendar and said,



"And when the moon is in the 'last quarter' it curves the other way. You see the *first* quarter of

the moon in the *West* just after sunset. I saw it last evening. But you see the *last* quarter in the *Eastern* sky just before sunrise. You will see it there in about a month from now."

"I never noticed that!" exclaimed Paul.

"I didn't either," said Betty.

"I always say that people who live in cities," said Grandma, "miss the best part of the day. They never see anything that happens in the world before eight o'clock."

Betty looked from the 'first quarter' picture of the moon on the calendar to the 'last quarter' picture, and back again.

"Seems as if we *ought* to understand it now," she said, "but I don't. Do you?" she asked, turning brightly to Peter and Paul.

They shook their heads and looked expectantly at Grandma. She tried hard to rise to the emergency.

"You see, children," she said, "when the first quarter of the moon lies on its *back*, with the horns straight up, so that the water in it can't run out of the horns, why then it's going to be a *dry* month; but when the first quarter stands up on one end, like it is in the calendar picture, then the water in the moon *can* run out, and it will be a *wet* month. My father, your great-grandpa Bassett, told me that when I was no higher than a chair, and I've never seen it fail," finished Grandma.

The children were puzzled; they looked at each other, and then at their smiling Grandmother. In a

moment Peter's eyes narrowed in a roguish way they had, and he said, "I wonder, did great-grandpa Bassett know Ossawatomie?"

Then something strange happened. Grandma actually blushed red in her cheeks, laughed, and shoved the "committee of inquiry" out of the kitchen. She asked Peter how he thought she was going to get the kitchen work done before noon, with three live question marks standing around.

Betty was the last one out of the room, for she stopped to slip her hand into the big cooky-jar in passing, and she heard Grandma murmur to herself, "Imagine his telling those children that old Indian nonsense!"

Either Grandpa or Grandma must be wrong about the way Luna Moon's bow tipped when it was going to be wet weather. They just couldn't *both* be right—and neither of them had given Betty the answer to Mr. Puck's riddle.

The next witness examined by the "committee of inquiry" was Otto, Grandpa's hired man. The children found him cultivating the hills of young corn with "Molly" and "Jerry."

Otto stopped the team at the end of a row and listened attentively to Betty's question about what Luna Moon shoots her arrows at.

Then Otto twisted his faded, straw-colored mustache a moment, while his blue eyes looked off across the field. They seemed to be looking clear across the ocean to Otto's "native place."

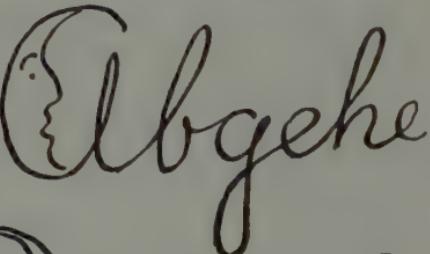
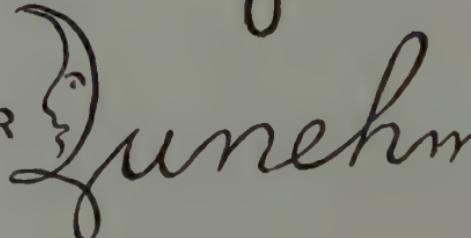
"I remember," said Otto, "my old schoolmaster,

ven I go to school in Steinplatz, tell me that. I show you."

Then Otto took the butt end of his whip and wrote these two German words in the soft cultivated dirt of the cornfield:

Abgehen
Zunehmen

Then Otto changed the curves of the letter A and Z to look like this and wrote "last quarter" and "first quarter" opposite each moon picture.

LAST QUARTER 
FIRST QUARTER 

"Oh, I see!" cried Betty, "What do the German words mean, Otto? Do they mean 'first quarter' and 'last quarter?'"

"No, no," said Otto, "I will show you. '*Abgehen*' means 'going avay' and '*Zunehmen*' means 'increasing.' You see the first quarter moon is 'increasing' toward being full; and the last quarter moon is 'going avay' from being full. The letters are bent the same vay like the moon's bows—vun vun vay and vun the odder. You see it now!" Otto decided, as he picked up the reins and clucked to "Molly" and "Jerry."

The children were still looking at Otto's drawings in the dirt when Paul suddenly cried,

"Oh, listen! I think I got the answer—to Puck's conundrum!"

"Shoot!" said Peter.

"It's like this," said Paul. "Luna Moon's first quarter bow aims down toward the sunset in the West in the evening.

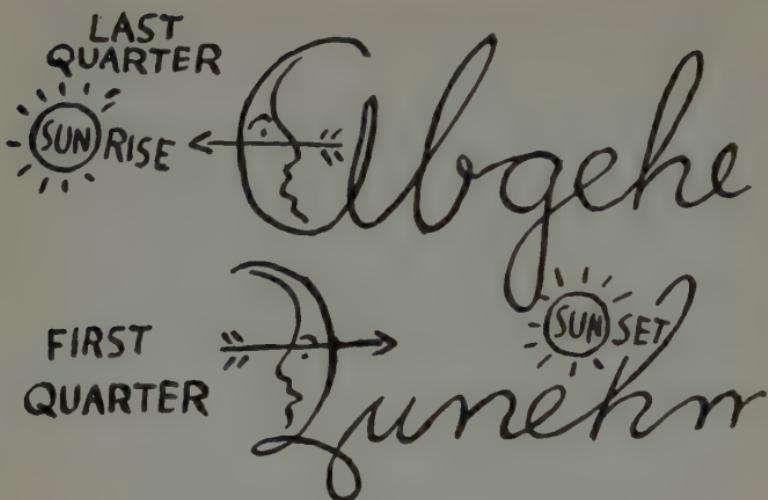
"Yes," said Peter.

"Well," Paul went on excitedly, "and her last quarter bow aims down toward the sunrise in the East in the morning, doesn't it?"

"Sure," said Peter, "we know that a'ready."

"Well," said Paul, "just let's draw arrows into Otto's moon-bows—and then put 'suns' in—one for the sunset-sun and 'nother for the sunrise-sun, and I bet we'll see what Puck meant!"

Paul quickly did it, and Otto's artistic efforts looked like this:



"Oh, I see!" cried Peter and Betty together, while they each gave Paul a look which proved that a prophet *can* have honor in his own country.

"Oh," exclaimed Betty, "the Lady Luna Moon always hunts the *sun* with her bent bow. The *sun*! That's what we'll tell Puck this evening. We've got the answer. The *sun*!"

Just then the breeze shook the branches of one of the apple trees at the edge of the cornfield, and something dropped lightly on Paul's head and bounded to the ground between the children.

They thought it was a small, green baby apple, when, of a sudden, Puck's squirrel-like, chattering laugh came up from under their very feet. It was really Puck, quite plainly to be seen, in spite of the fact that the children were not in the Fairy Ring at all.

"Where *did* you come from?" cried Betty. "Oh, how you scared me!"

"I brought the right answer," piped the little green man with the puckery face. "The right answer shouldn't frighten anybody. The only time when terrible things begin to happen is when you say 'twice seven is sixteen.'"

Puck pursed his tobacco-pouch lips, winked one blue, sparkling eye at Peter and the other at Paul, and suddenly sprang straight upward, landing on his feet, like a bird, upon a low-hanging twig of the apple tree. Then he sat down on the thin twig, as expertly as tight-wire walkers do in the circus, began to sway to and fro in the breeze, and started to talk in his pipy little voice.

"Mr. Dexter R. Optick," began Puck, "lives in the valley just to the West of Nose Hill—and Mr. Sinister L. Optick, his brother, lives Eastward, in the valley just over the hill."

"Are they brothers, Mr. Puck?" inquired Peter.

"Aye, twin brothers," said Puck, "but neither has ever seen the other."

"How funny!" shrilled Betty. "Haven't they *ever* seen each other?"

"Well," said Puck, "hardly ever. Only by hearsay, or rather mirror-say. Mr. Dexter R. Optick sees everything that goes on to the West of Nose Hill, and Mr. Sinister L. Optick can tell you all the matters that happen to the East of it, but when it comes to knowing each others' doings, they just

have to believe what Looking-Glass, the Gossip, tells them, or be ignorant."

This picture shows you which sides of Nose Hill Mr. Dexter R. and Mr. Sinister L. Optick live on. When you know that, you'll probably be able to guess what their middle names are.



Puck suddenly stopped talking, and seemed to be listening intently. Then he stood up on the twig and began to jounce it up and down, as a bather does the springboard before he dives.

"I'm off!" cried Puck, teetering violently, "I'm the slave of Fairy Wonder Rings everywhere, you know, just like Aladdin's Genie of the Lamp. A

little boy in California has just walked into a Ring—and he's wondering why bees go into flowers—so he'll need me in a few minutes. See you in the Stump-Meadow after supper! I'm off!" cried Puck again—as his springboard twig threw him up into the air. That was the last the children saw of him that afternoon.

THIRD REEL

WHY THE PRINCESS ISTAR LOSES AND GAINS HER JEWELLED ROBES—AND MORE ABOUT THE OPTICK BROTHERS AND WHAT THEY LEARNED OF LUNA MOON

THE children, and Betty particularly, could hardly wait until evening to tell Puck the answer to the riddle of Luna Moon's bow.

"I bet that he knows a'ready that we guessed it all by ourselves," said Paul, as the three walked across the Stump Meadow toward the Fairy Ring after supper. "I sort of *felt* him around when I was drawing the arrows into Otto's first and last quarter bows."

"Well," said Peter, "he promised Betty to tell her anything she wanted to know 'bout Luna, if she could just answer the riddle to-night, so I guess it won't make any difference whether he knows we found out all by ourselves or not."

"Otto helped," said Betty. "We shouldn't have guessed it if Otto hadn't helped."

The Young Moon's crescent was shining clearly in the last of the sunset glow as the children arrived at the Wonder Ring. Luna was not quite so slender as on the previous evening, and her bent bow was seen higher in the sky as the glow faded.

“Last night,” said Paul, “the lady’s bow was right close to that bright evening star, and to-night the bow is away up above the star. I wonder why?”

“I’ll ask Puck,” Betty promised him.

Just then the children reached the Ring, Peter carrying the lantern, Betty ‘Rags’ white rubber ball, and Paul his own head. All were full of curiosity as to what Mr. Puck could possibly want with these three objects.

When the children were still outside the Fairy Ring they saw nothing of Puck in or out of it, but the moment they had crossed its magic edge there he was, sitting cross-legged on the mossy stump. His eyes were wide, like those of a sleepwalker, his lips were moving, and he stared dreamily at the moon. He seemed not to notice the arrival of the children and talked to himself, half aloud, in a strange language that they knew was neither French nor German.

Now and then Puck spoke the word “*Istar*” as if he loved its very sound, and when he did this he bowed his head down between his knees and stretched his arms out straight before him.

Betty put her lips close to Paul’s ear and whispered “He must be praying to the moon.”

Puck sat up straight and turned toward the children. He gazed at them steadily for a moment and the far-away look went out of his eyes.

“Petrus,” he finally said, “canst tell me what is the *Taj Mahal*?”

Paul hesitated

"I like the sound of it," he said, "it sounds like some of the words in Mr. Kipling's stories of *Mowgli*, or *Kim*. It makes me see pictures of elephants with embroidered blankets, and howdahs on their backs."

"Right thou art, Paulus," said Puck softly. "The *Taj Mahal* is the jewel of India; a building of frozen dreams, and music and moonshine. My spirit was but now sitting before it, making my obeisance to the daughter of the Moon Goddess—to *Istar*—beautiful Moon Princess."

Puck's eyes became dreamy again. He sat quiet and seemed to have forgotten the children, and when he began to speak again it was half to himself:

"When the world was young; when the world was small; when the Great Pyramid was yet an unborn dream—then was *Istar* great in India. She was great—and the fame of the shining, jewelled beauty of the Moon Goddess' daughter came even to the Underworld below the sunset—to the ears of the mighty God of the Dead.

"And the Lord of that Underworld, living always in dim shade, made his demand that the daughter of the Moon Goddess visit his realm once every month—and since his power was great, it was so. Even to this day *Istar* must go to the Land of the Dead, once every month.

"From the heights of the sky she starts—just after the full of the moon—and each day *Istar* passes through one of the gates of Day and Night, on her way to the Land of the Dead.

“Each time she passes through one of the dim portals some part of her joyous, pearly robes is taken away by the Moon Goddess, her mother, and in its place a mourning veil of smoky dullness is draped about her form.

“Day after day she passes the portals that lead to the Underworld, and day after day her bright dress grows less and her dull robes cover her more completely, for the Moon Goddess is determined that the Lord of the Dead shall never see *Istar*’s face and form in its beauty.

“And so it comes to be that when *Istar* passes the last portal, and enters the country of the shades, she is all in black from face to feet.

“It is no marvel that the King of the Dark sees no beauty in her veiled face and form and soon gives her leave to start her return journey.

“It is then that the Moon Goddess, her mother, begins to rejoice. From the Isles of the Blessed, where the Gods live, she runs singing to meet *Istar*, carrying with her the joyous, pearly robes of gauzy moonshine.

“At the first portal of Day and Night she meets her child, in rapture takes away some part of the veils of gloom, and in its place clothes *Istar*’s body in the garments of woven light.

“At each portal that *Istar* passes through, her mother replaces with robes of light the heavy veils of her darkness, until once again *Istar*, the Moon Princess, mounts her throne in high-heaven—and from radiant hair to white-shod feet she shines in

the full, exquisite beauty that is the chief joy of the gods in Nirvana, the seventh heaven."

The children were quiet for some time after Puck had finished the story of *Istar*.

Then Betty said,

"It's a lovely story. I wonder why it is that all the most beautiful stories aren't true."

"But they *are* true," cried Puck, suddenly losing all his dreaminess. "All the most beautiful stories are really true. That is why they are beautiful. When you really understand the truth of *Istar's* story—the truth *behind* it—you will see that it can't help being true."

"But how can we learn the truth behind it, Mr. Puck?" asked Peter.

"How didst learn the truth about Luna Moon's bow and what she is ever aiming at?" inquired Puck.

"Why—it—it—just *came* to us, when we thought about the drawings Otto made in the dirt," answered Peter.

"Right thou art!" said Puck. "The right answer *always* comes. Petrus has the lantern; the little lady the white ball; and Paulus his head. We will put them together—the right answer will come—and we shall know the truth of *Istar's* beautiful story."

"How do we start? Let's begin! That's dandy!" cried all the children at once.

Puck stood up on the stump, pursed his puckery lips and gave a long, shrill whistle. Then he called loudly,

“Dexter, oh Dexter Optick! Ah, there thou art, in Paulus’ head—and over Nose Hill I see thy brother Sinister Optick. We shall need you both to learn truth.”

Then, at Puck’s direction, Peter held the lantern upon the crown of his head; and Paul walked around Peter in a circle, as the earth moves round the sun; and Betty held up the white ball at the level of Paul’s head, while walking around him as the moon moves around the earth.

The white ball in Betty’s hand stood for the moon, and Paul’s head stood for the earth, and the children looked like this in the gathering dusk.



You see that the lantern lighted only one side of the ball and Paul’s head, just as the sunlight brightens only one side of the moon and the earth.

You see too how the Optick brothers, who live on opposite sides of Nose Hill, look out from the valleys of Paul's face, where they live, just as you do from your home on the earth.

When Paul's head turns from his right to his left, just as the earth turns on its axis from West to East, the lantern, or sun, goes down behind Nose Hill, like this:



The valley where Mr. Sinister L. Optick lives is already in shadow, but the setting sun still shines upon Mr. Dexter R. Optick's valley on the West side of Nose Hill.

If we could climb up a tree and look down on the top of Paul's head it would look like this—with the light from the setting sun-lantern shining on the West side of Nose Hill and Dexter Optick's home:



And if the moon-ball is in the position shown in this picture, just in direct line with the sun, neither Dexter nor Sinister Optick, nor anyone else on the earth, can see a bit of the bright half of the moon-ball—the side that the sun-lantern lights up. Then we say that the moon is “new.”

“That’s the time Grandpa calls ‘the dark of the moon,’—the best time to plant things to make them grow, isn’t it?” asked Betty.

“Yes,” said Peter, “it’s the ‘dark of the moon’ all right, but Grandma says it’s the *worst* time to plant potatoes.”

Puck looked from Betty to Peter, turning his head with the quick movements of a squirrel. Then he pursed his lips, gave a long, low whistle and said,

“What say the potatoes upon this weighty matter?”

None of the children had asked the potatoes.

“But I have,” Puck assured them, “I have had speech with the potatoes—and I got one word, and only one, from them as to what time of the moon was best for them to grow in. One and all, the potatoes answered with the same word, and it was, ‘Mumbo-Jumbo.’”

The children all gave Puck puzzled looks. “Mumbo-Jumbo” didn’t sound like an answer to such a question at all. Finally Betty said,

“Please, Mr. Puck, can’t you—will you—translate what the potatoes said—explain it a little bit?”

“Certainly,” said Puck soberly, “it means that they all stood up and began to wrestle, catch as catch can, until the little red button on the cap of the Grand Panjandrum himself burst with a loud roar—and the gunpowder ran out of the toes of their boots.”

“But, Mr. Puck,” cried Betty, more puzzled than ever, “*that’s* nothing but nonsense!”

“Of course!” Puck agreed with a bored air, “*that’s* just what the potatoes said, and they ought to know—they do the growing.”

“Come,” he continued more brightly, “come

back into your positions again. We would wish to see with our eyes how *Istar* the Moon Princess looks, after her royal mother has met her at the first portal of Day and Night on her return from the Lord of the Dark."

The children took the positions they had before (when we imagined a tree, and climbed up it, and looked down and saw the top of Paul's head), like this:



As before, the moon-ball was directly in line with the sun-lantern and Paul's head, so that the Optick brothers could see only the moon-ball's dark side.

Then Betty, at Puck's direction, carried the white ball a little way along the curve of its circle around Paul's head, as you see in this picture.



After it moved, both the Optick brothers could see a little bit of the lighted side of the ball; and when they saw that the lighted part, just coming into sight, was thin and curved like the crescent moon beginning its first quarter, they told Paul and he cried in great excitement,

“Oh, Betty! I see now how Luna Moon gets her bow, and how it gets wider and wider, until the moon is full!”

The picture you have just looked at shows how the moon-ball would have looked if you could have viewed it from above Paul’s head, and the next picture shows how the Optick brothers saw it at the same time, from the valleys where they live.

You see that it looks just the same as the moon does to you from your home on the earth at sunset time, when Luna Moon is a couple of days beyond her “new moon” position.



“Ooo!” cried Betty impatiently, “I want to have my Optick brothers see too!”

So Betty took Paul’s place while Paul held the ball, and after that Peter had his turn.

Then Puck had Betty keep on moving the moon-ball around Paul’s head until the Optick brothers had seen it go through all its changes or “phases”—“new moon,” “waxing crescent,” “first quarter,” “gibbous moon,” “full moon,” “gibbous moon” again, “last quarter,” “waning crescent,” and back to the “new” or “dark of the moon.”

The moving-picture play on the following pages shows just how Paul's head and the moon-ball looked from above; how the moon-ball looked to the Optick brothers at each stage of its trip around Paul's head, from "new" moon to "full" moon, and back again to "new" moon; and how the real moon looks at each of its changes through a month.

Next time you see Luna Moon's thin bow in the West, just after sunset, imagine you are Dexter or Sinister Optick, living beside Nose Hill on Paul's head, and imagine that you see the moon-ball, in the light of the sun-lantern.

Then watch Luna Moon go through all her phases night after night for a month, still imagining that you are one of the Optick brothers looking at the moon-ball, and you will understand how the moon waxes and wanes just as well as Betty and her brothers understood it.

After you have done that, you are sure to say, just as Betty did,

'I'm *terribly* glad all the beautiful stories are true too!"

The Sky Movies Presents

**“Jack and Jill
in the Moon”**

*Continuous from
January to December*



HOW TO EXHIBIT THIS "MOVIE"

Hold the book in the hands as shown in the picture below. Then, as the pages under your right thumb are rapidly released, one by one, you will see:

- how the moon waxes and wanes
- how it goes around the earth every month
- how the Optick Brothers see the moon's changes
- and how "Jack and Jill in the moon" go up the hill and down again.

Run the movie through several times and have fun watching something different each time.



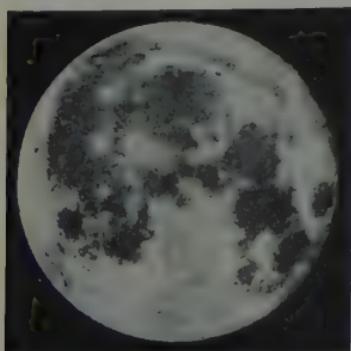
See "Jack and Jill in the Moon?"



© The Knapp Co.

Of course there is nobody who doesn't know the man up there—and 'most everybody can see the lady—but how many know how to see Jack and Jill in the moon?

They are there—really they are—and these two little pictures will help you to see them. The first picture is a photograph taken by an astronomer at the great Yerkes observatory. Perhaps he didn't suspect that Jack and Jill were going to get into the picture too—but there they are.



“Jack and Jill went up the hill,
To get a pail of water;
Jack fell down and broke his crown,
And Jill came tumbling after.”

NOW that you know how to see Jack and Jill in the moon, you can actually watch them do all the things the nursery rhyme tells about.

The sky is the “hill,” and since the waxing moon is seen higher in the sky every night you can see how the moon children climb the hill of the sky too.

Then, as the moon wanes, Jack’s curving side or “crown” of it gradually gets “broken” and dark and soon Jack himself has “fallen” out of sight.

After that it isn’t but two or three days until Jill has “tumbled after” him—and there is nothing left of the moon itself but a narrow crescent in the East before sunrise.

How about the pail of water Jack and Jill went up the hill to get?

Well, don’t you often hear people say,
“It will rain when the moon changes”—
or, “After the moon is full there will be a storm?”

Of course, the rain doesn’t always wait for Jack and Jill in the moon to tumble down and spill their pail-ful of it over us, but lots of

people still believe that the moon controls the weather.

The story of Jack and Jill is a very, very old one. The first time it was told it was meant for a description of the way the moon waxed and waned, and seemed to bring down the water from the sky. Now most people have forgotten the original meaning, and the story of Jack and Jill is just repeated as a jolly nursery rhyme.

We say that Jack and Jill is a *nature myth*. That means a story that was made up in the beginning to describe something that keeps happening in Nature. The simple people of long ago explained the actions of the moon by telling about Jack and Jill. We explain them by understanding what really happens, as Puck and the children did in the "reel" of this book that you have just read.

WAXING CRESCENT

(Photograph by Mr. R. J. Wallace)

Optick Brothers see narrow
crescent in West at sunset.

Moon's Age: $3\frac{3}{4}$ days.

Jack and Jill cannot
be seen yet.

JACK AND JILL IN THE MOON 39



WAXING CRESCENT

Opticks see a wider bow, higher in the West at sunset.

Moon's Age: $5\frac{1}{2}$ days.

Jack's feet begin to appear in center of crescent.

JACK AND JILL IN THE MOON 41



FIRST QUARTER

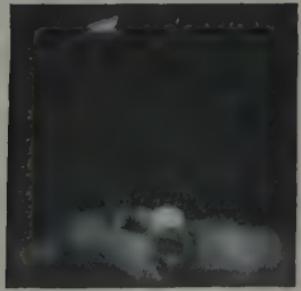
(Photograph by Mr. R. J. Wallace)

Opticks see the moon
half-full in Southern
sky at sunset.

Moon's Age: $6\frac{1}{4}$ days.

All of Jack's legs and
part of his body can
now be seen, and he
has gone a long way
up the "hill" (the
sky).

JACK AND JILL IN THE MOON 43



FIRST QUARTER

Opticks see the moon
a little farther toward
the East at sunset.

Moon's Age: $7\frac{1}{4}$ days.

All of Jack's legs and
body are now visible,
and his head is coming
into sight.

JACK AND JILL IN THE MOON 45



GIBBOUS * MOON

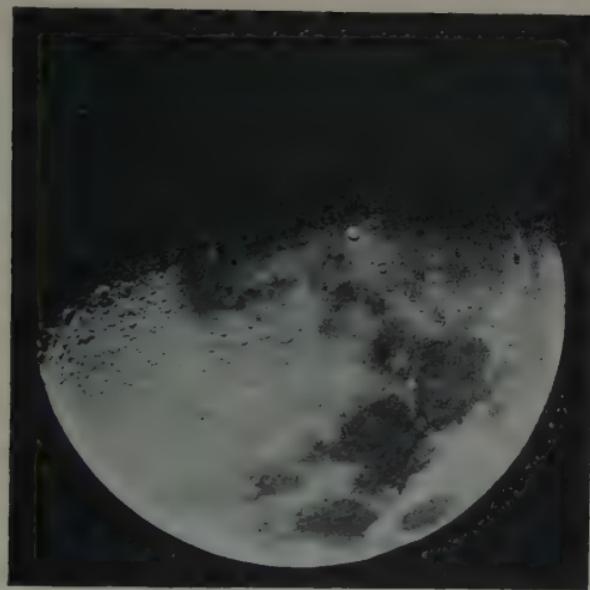
(Photograph by Mr. G. W. Ritchey)

Opticks see the moon
more than half full far-
ther toward the East
at sunset.

Moon's Age: $9\frac{3}{4}$ days.

All of Jack, including
his head, can now be
seen. His right arm
holds on to the pail
in the center of the
moon.

* "Gibbous" means having the bright
part greater than a semi-circle or less
than a full circle.



GIBBOUS MOON

(Photograph by Mr. R. J. Wallace)

Opticks see the moon
still farther toward the
East at sunset time.

Moon's Age: $11\frac{3}{4}$ days.

All of Jack is now in
sight and nearly all of
Jill, with the pail held
between them. Jill
takes more imagina-
tion to see than Jack
does.

JACK AND JILL IN THE MOON 49



FULL MOON

(Photograph by Mr. F. Slocum)

Opticks see the full moon rise in the East at the same time that the sun is setting in the West.

Moon's Age: $14\frac{1}{2}$ days

All of Jack and Jill are now in sight. They have climbed the hill of the sky as far as they can get away from the sun.

JACK AND JILL IN THE MOON 51



GIBBOUS MOON

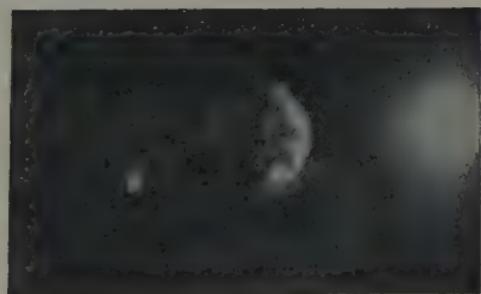
(Photograph by Mr. G. W. Ritchey)

Opticks see the moon
rise in the East after
the sun has set.

Moon's Age: 18 days

Jack's curve or "crown" of the moon is badly "broken," and he is beginning to "fall down" out of sight.

JACK AND JILL IN THE MOON 53



GIBBOUS MOON

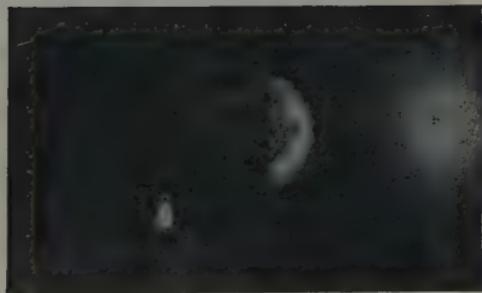
(Photograph by Mr. G. W. Ritchey)

Opticks see the moon
rise later in the even-
ing.

Moon's Age: 20 days

Jack is nearly all gone
except his head. Jill
is getting ready to
“tumble after” him.

JACK AND JILL IN THE MOON 55



LAST QUARTER

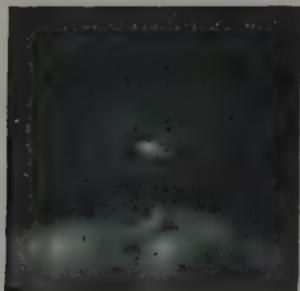
(Photograph by Mr. G. W. Ritchey)

Opticks see the moon
rise still later at night.

Moon's Age: $20\frac{1}{2}$ days.

Jill is just beginning
to go "tumbling"
after Jack down the
hill of the sky.

JACK AND JILL IN THE MOON 57



WANING CRESCENT

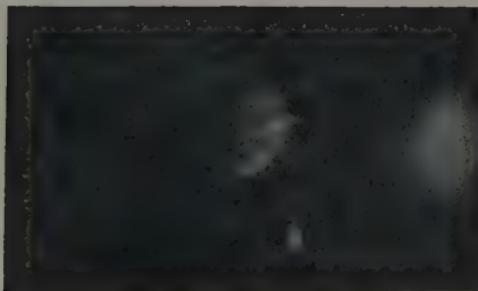
(Photograph by Mr. R. J. Wallace)

Opticks see the moon
rise very late in night
and see it in the sky
after sun-rise next
morning.

Moon's Age: 24 days.

Jill is about all gone
too.

JACK AND JILL IN THE MOON 59



WANING CRESCENT

Opticks see the moon
rise only a little while
before the sun does,
and see it in the sky
in the day time.

Moon's Age: $24\frac{7}{8}$ days.

Jack and Jill have
now both tumbled
down the sky.

JACK AND JILL IN THE MOON 61



WANING CRESCENT

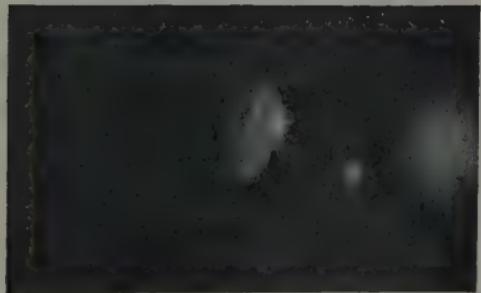
(Photograph by Mr. R. J. Wallace)

Opticks see the thin moon bow in the sky at dawn, while the sun is rising.

Moon's Age: 27 days

Jack and Jill are now getting ready to climb the hill of the sky again, after the time called "new moon," when the dark side is turned toward us, and nobody can see even a thin bow of light.

JACK AND JILL IN THE MOON 63



NOW LET US THANK THE ASTRONOMERS AND EVERYBODY ELSE WHO HELPED US

The wonderful pictures of the moon that you have just seen in our "Sky Movie" theater were shown by special permission of the Yerkes Observatory, and by arrangement with D. Appleton and Company, who used them in Mr. Garrett Serviss' book called, "The Moon."

Some of these photographs were taken with a twelve-inch telescope at the Yerkes Observatory, and some of them with the largest refracting telescope in the world, which is also there. There is a picture of this big Yerkes telescope on page 121.

We also wish to thank the director of this observatory for permission to show you the photographs of Venus, Mars and Saturn.

The fairy ring picture is used in our book by permission of the U. S. Department of Agriculture.

The picture of Jack and Jill, by Clara L. Burd, is printed by the courtesy of the Knapp Company.

The author is also indebted to the following books for facts, ideas and suggestions:

Todd: *New Astronomy*

Jacoby: *Astronomy*

Snyder: *The World Machine*

Fiske: *Myths and Mythmakers*

FOURTH REEL

IN WHICH THE CHILDREN LEARN HOW TO SEE THOUGHTS—JUST LIKE PICTURES—AND HOW MONSIEUR FOUCAULT PROVED THAT THE WORLD SPINS LIKE A TOP

WHEN the children had arrived at Grandfather's house from the Fairy Ring, after Mr. Puck had helped them to know the truth about *Istar*, the Moon Princess, they had a pleasant surprise.

Just as they had come into the barnyard with their lighted lantern, Grandfather had driven in, riding in his buggy, with "Molly" pulling it; and sitting beside Grandfather was Uncle Henry!

They could hardly wait for him to get out and get into the house, and see Grandmother, before they carried him off to the front porch and told him all about Puck and *Istar*, the Moon Princess.

Uncle Henry was very glad indeed to hear all about it, as they knew he would be, and he said,

"I was sure you'd get into a Wonder Ring, and I knew that just as soon as you did you'd find out some wonderful things and have lots of fun."

"Yes," said Betty, "and it was such fun! Puck is so cunning I can hardly bear to see him go when he disappears; he would make such a wonderful doll!"

Uncle Henry laughed.

"If you had Puck for a doll," he said, "he would be kept in a drawer and you'd always know just where he was—but now you never know just when or where he is going to appear. You just know he'll turn up and bring the right answer if you wonder and think enough, and that he'll appear when you least expect it. That makes him lots more interesting, doesn't it?"

The children all agreed that it did.

Then Peter said,

"Of course I know that it's true—because everybody says so, but how do people really *know* that our whole world turns clear around every day, the way the geography globe does on its iron axle-rod?

"The whole sky *seems* to turn around *us* and move over us from East to West. How did people prove for *sure* that it's really the earth turning the other way that makes the stars and sun and moon rise and move across and set?"

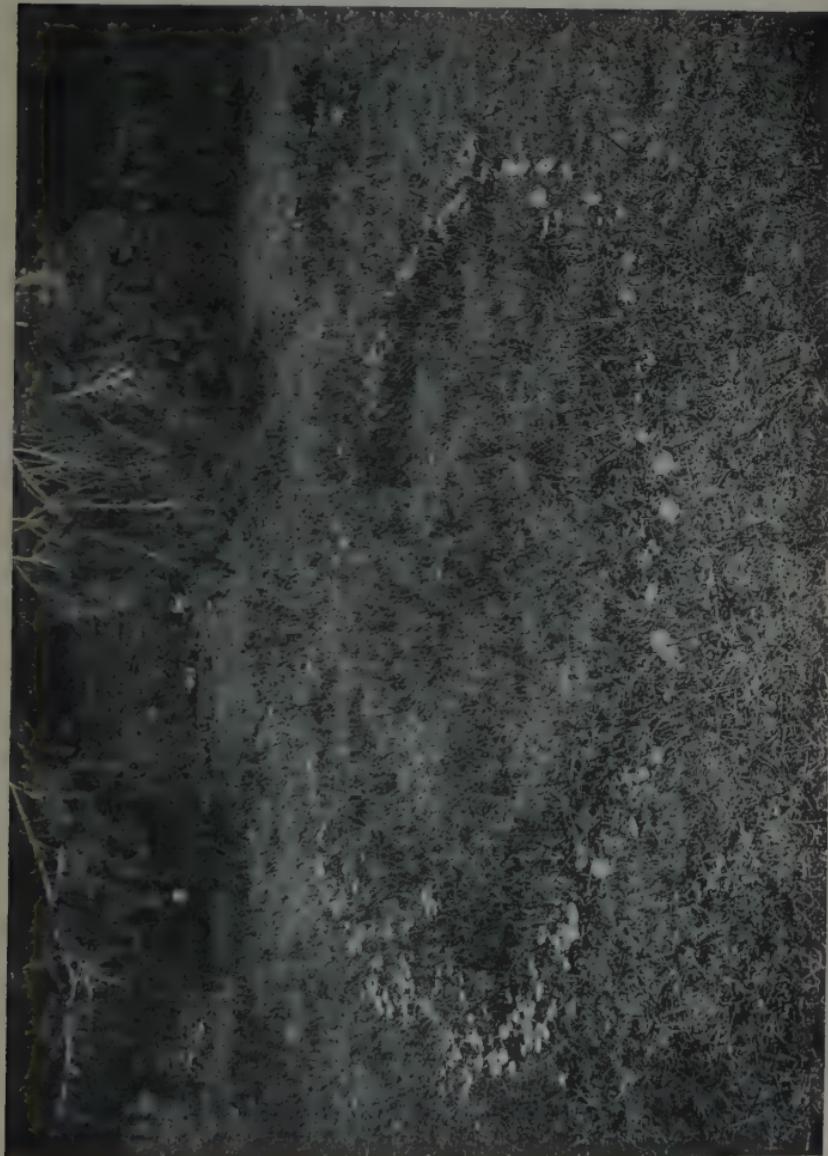
"Let's try and find out to-morrow," said Uncle Henry. "We'll go out and stand in the Fairy Ring and wonder real hard—and maybe Puck will bring the answer to us."

"All right," cried Betty, "let's!"

The boys agreed, so Uncle Henry went in and to bed, for he was tired from his trip from the city.

Next morning, however, the children carried him off to the Fairy Ring right after breakfast. Uncle Henry admired it very much—it was such a beau-

tiful, big one! If you have never seen one yourself this will be a good time to show you how they look.



Courtesy U. S. Dept. of Agriculture

Uncle Henry told the children that the little fairy umbrellas were not toadstools, as they thought, but mushrooms, so you may as well know too.

This isn't a picture of the very same ring in which Puck first appeared to Peter and Paul and Betty, but it is one just about like it, and since Puck is the slave of every Wonder Ring in the world he probably appeared in this very one in the picture some time or other.

Uncle Henry explained that Wonder Rings probably start from just a few mushrooms, perhaps only one. The seeds of the mushroom get scattered in a circle around it, and next year a circle of grown-up mushrooms appear. Then these in their turn scatter seeds over a wider circle, and these make grown-up mushrooms the next year, and so on.

Some Fairy Rings are supposed to be five or six hundred years old, so Puck must have been called to bring answers to them a great many times.

Uncle Henry and the children stepped into the Ring and wondered and wondered about how we can be sure that the earth really turns around, but nothing happened. Puck didn't appear at all.

Betty said,

"Maybe he's off in California again showing that boy some more about the bees and the flowers."

Uncle Henry thought not.

"Let's walk back to the barn," he said, "I have an idea that maybe we'll find him there."

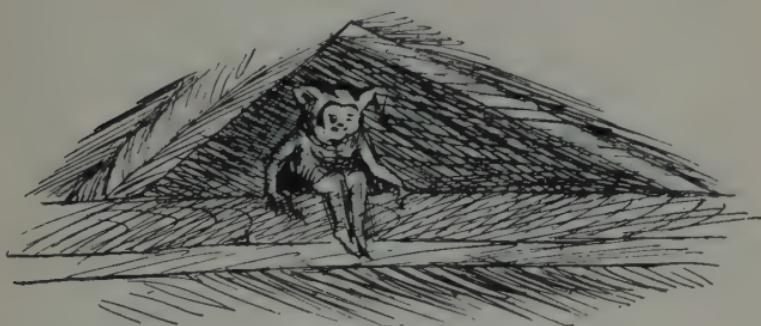
When the children and their Uncle came back

to the barn Uncle Henry said he felt sure that Puck must be hiding somewhere about, so the children started looking for him.

Betty turned over a rusty old tin pail that was upside down on the floor, but Puck wasn't under it. Paul looked under the seat of the buggy, but all he found was a coil of thin, smooth fence wire that Grandfather had brought from town the day before.

Just then all the children heard Puck's chattering, bubbling laugh—just the way they had heard it the first day they had seen the little green man on the stump. The laugh seemed to come from high over their heads, away up among the dim cobwebs under the roof.

When they all looked up they could see nothing at first, the light was so dim, but when their eyes got used to it they saw Puck sitting on a big beam that crossed the barn from side to side a few feet below the roof.



He looked down and said cheerily,
"Hello, Petrus and Paulus! Hello, little lady!
Hello, Old One!" Uncle Henry was only twenty-

five, but that *is* rather old after all, and he didn't seem to mind being called "Old One" at all, so Puck never called Uncle Henry anything else after that.

"I'm sending down a spider on his own spider thread," Puck continued, "he'll be down in a minute. When he gets there, give the spider the end of a spool of cotton thread and he'll haul it back up here to me."

Betty rushed off to the house, and was back in a minute or two, after making a swift raid on Grandma's work-basket. By that time the spider had let himself down, all the way from the beam, on a tiny, silken cord of his own spinning.

You have seen spiders do this lots of times, and haul themselves back up to where they came down from afterwards too.

Well, when the spider was down within reach Uncle Henry unwound a lot of the fine cotton thread from Grandma's spool and gave the end of it to the spider, and back the clever insect went with it, climbing his own silken cord, up to Puck on the beam above.

Then, when Puck had taken the end of the cotton thread from the obliging spider, he braced his feet and got ready to pull hard, while Uncle Henry took Grandpa's coil of smooth wire out of the buggy box, made a wire loop in one end of it, and tied the thread onto it. Then Puck hauled and hauled on the thread, and up and up went the wire until the end of it was in Puck's hands.

It was only the work of a minute for him to wind the wire tightly around the beam and twist and tie its end firmly in place—and then Puck came sliding down the wire to the children on the barn floor.

Peter and Paul and Betty were thoroughly mystified now, and Peter said,

“What has all this got to do with the world turning round every day, Uncle Hen?”

“You’ll see pretty soon, Pete,” said Uncle Henry reassuringly. He was looking closely at the rusty old water pail and now he brought it over to the centre of the barn floor, where the wire hung down from the beam above.

“That’s why Grandma threw it away,” said Betty, putting her little finger through the hole in the middle of the pail’s bottom.

“We can soon fix that,” smiled Uncle Henry, “Pete, just step out and cut a strong, straight twig from one of the apple trees.”

Peter ran to do it, and when he had brought a twig about a foot long Uncle Henry forced the cut end of the twig into the hole and made the pail so that it wouldn’t leak. But instead of cutting off the end of the green stick below the pail’s bottom, Uncle Henry left it sticking straight down.

The children’s eyes were now popping out with curiosity and they opened wider still when Uncle Henry fastened the handle of the pail to the wire hanging from the beam and adjusted it so that the leaf at the end of the twig just brushed the boards of the barn floor, like this:



"Now, Paul," commanded Uncle Henry, "you and Pete bring a few shovelsful of moist earth from the garden and pack the pail with it until the dirt is level with its top."

The boys did this quickly, with Puck dancing impatiently around the hanging pail. The moment the earth was smoothed off level with the top Puck gave a leap and landed on the soil and pebbles in the pail.

Then it looked like this as it hung from the beam about forty feet above.



"Now," said Uncle Henry, "we'll rummage in the tool chest a minute and then go ahead. I want father's plumb-bob."

He found it after a search of a minute or two in the tool chest behind Molly's stall, tied a piece of string to the bob and to a foot rule, and handed it to Paul, who looked like this, as he held the rule in both hands.



"Now," said Uncle Henry, "I'm going to start the heavy plumb-bob swinging back and forth at right angles to the ruler. Then Paul will quickly turn the ruler so that it points straight out away from his hips instead of being parallel to them as it is now. Then all of you watch the plumb-bob and see what it does."

The bob was set swinging like the pendulum of a clock. It swung back between Paul's feet and then straight out away from him—back and forth—back and forth. Then Paul suddenly turned his hands so that they were in this position.



The ruler was now just at right angles to the position it was in before.

The children watched the plumb-bob closely.

"It isn't doing anything *different!*" cried Betty, "it just keeps on swinging back and forth between Paul's legs."

"No," said Uncle Henry, "the pendulum will keep on swinging in just the same direction it started, no matter how we turn the ruler it is hung from.

"Now suppose that we started the pail of dirt swinging on the wire that hangs from the roof beam up there, and then suppose that Paul was an immense giant, and could pick up this whole barn and suddenly turn it a quarter of the way round and set it down again."

The children did their best to suppose that Paul was a giant big enough to do it. These were the pictures they saw in their imaginations:



"Now," said Uncle Henry, "what would the swinging pail of dirt do while Giant Paul picked up the barn and turned it round?"

The children thought a moment and then Peter said,

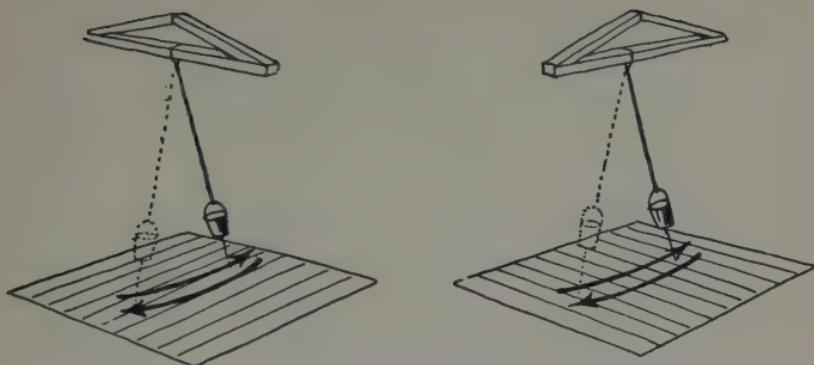
"I suppose it would keep on swinging in the same direction it started in—just like the plumb bob does."

"Well then," Uncle Henry continued, "if the pail was swinging *lengthways* of the barn, along the line of the cracks between the floor boards, how would it be swinging after Giant Paul had turned the whole barn, floor and all, through a quarter of the circle?"

"Why," said Paul, "I would be turning the whole barn of course, floor, roof, and all, so—so I guess the pail would swing *crossways* of the barn after I had turned it."

"That's right," smiled Uncle Henry. "We're getting on famously. The pail would be swinging *across* the cracks between the floor boards after you had turned the whole barn a quarter of the way round. Do you all see that?"

The children thought a minute and succeeded in imagining that it would be so. These two pictures show how the pendulum would keep on swinging in the same direction all the time, and you can see that after Paul, the Giant, had turned the barn, the pendulum would be going *across* the cracks of the floor instead of parallel to them.



"Do you think," asked Uncle Henry, smiling. "that you could imagine something else now—something that is a little harder?"

"We'll try anything once," said Peter, speaking for the crowd, and the others said, "Sure!"

The children and Uncle Henry had not been paying any attention to Puck, but now he suddenly interrupted.

"Think! Old One!" he cried from a dark corner of the barn behind the feed box. "Think hard of the picture you would make Petrus and Paulus and the little lady to see—and then look upon the web."

Then the children saw that Puck was standing upon the feed box, pointing to a great circular spider's web filling the entire corner of the walls behind him.

Uncle Henry must have started to think hard at once, for suddenly a picture began to appear on the screen of cobwebs in the corner behind Puck, just exactly as if it was being thrown there by a moving-picture machine.

First the top of a great globe appeared, turning slowly around. It was covered with ice and snow, so the children knew at once that it must be a picture of the arctic regions at the north pole of the world.

Then the children were startled to see Grandpa's barn appear in the picture. It appeared to be standing on the ice exactly over the end of the axis the great globe was slowly turning around upon.

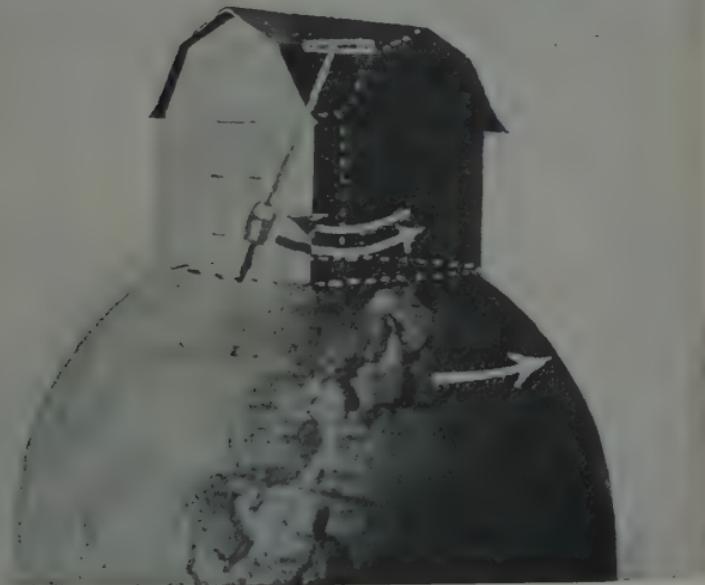
The picture on the cobweb screen now looked like this:



After the globe had turned once completely around with the barn turning with it, the walls of

the barn in the moving picture became transparent, like glass, and through them the children and Uncle Henry saw the heavy pail of earth swinging back and forth from the beam in the roof.

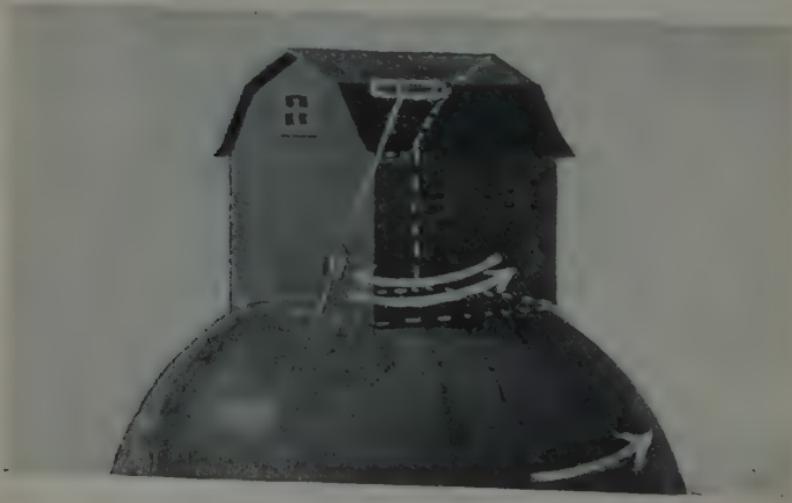
First it was swinging lengthways of the barn like this:



Then, as the great globe turned the barn round just opposite to the way the clock hands turn, while the pail kept on swinging in the same direction all the time, the children soon saw that the swings were from *side to side* of the barn floor, instead of from *end to end* of it, like this:



After the globe had turned another quarter of the way round, the pail again swung lengthways of the barn floor, but the front of the barn, with its big doors, now faced away from the children and Uncle Henry, like this:



Another quarter turn of the globe showed the pail once more swinging crossways of the barn floor:

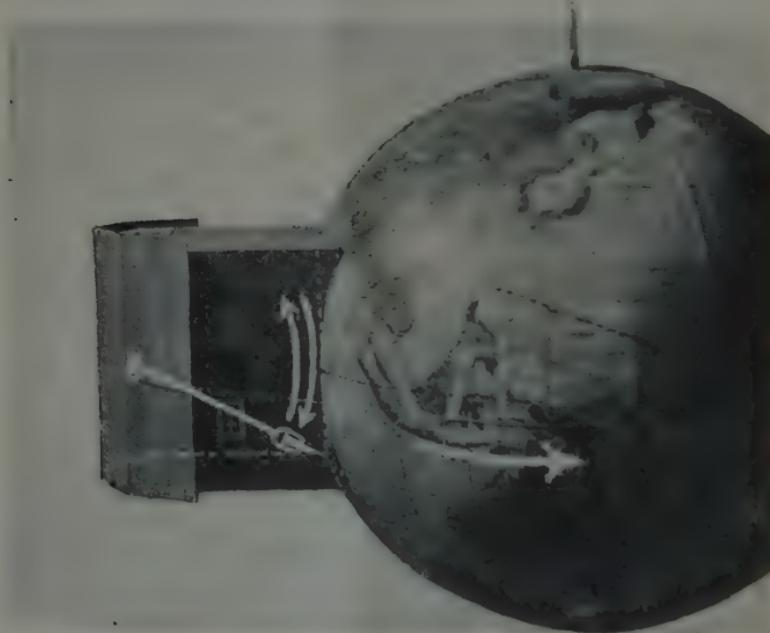


And finally, after the globe had made one complete revolution, turning the barn entirely around with it, the pendulum was again swinging lengthways of the barn floor, with the barn doors facing the children, just as the moving picture was when it started, like this:



"Thou art a good thinker, Old One!" cried Puck to Uncle Henry as the picture on the spider web faded slowly out. "Now think hard once more—until a new picture moves upon the spider's silvery web—the picture thou and I know of!"

Almost at once the new picture Uncle Henry had in his mind began to be visible on the spider's web, and, as before, Grandfather's barn appeared upon a great, slowly-turning globe—but this time the barn was seen, not at the ice-bound pole, but at the hot, tropical equator, like this:



The heavy pail of earth was swinging in a North and South direction, just at right angles to the equator of the globe; and as the globe slowly turned

the children watched to see the pendulum swing crossways of the barn floor, as it had before, but nothing of the sort happened. Even when the globe had turned half way round, the pail was still swinging North and South, lengthways of the barn floor, like this:



"Oh, I see!" cried Peter, "the pendulum doesn't swing crossways, and stays swinging lengthways, because at the equator the barn doesn't turn around in space. It's different when the barn is at the pole."

"Right," said Uncle Henry. "Now we, here in this real barn, are located somewhere between the equator and the pole of the real earth—about half-way between. It happens that father built this

barn so that the long way of the floor is almost exactly North and South. You can tell that by looking at the weather vane on the cupola. If we should set the heavy pail of earth swinging exactly North and South, what would happen to it while the world revolves from West to East?"

"Oh," exclaimed Betty suddenly, "now I see what the apple twig sticking down from the bottom of the pail is for!"

"Do you?" said Uncle Henry smilingly. "What is it for, Betty?"

"Why, I'm sure I *see* it, in my mind you know, but I don't know whether I can *tell* it or not."

"Try anyway," Uncle Henry encouraged her.

"Well," began Betty, "if we start the pail swinging, it's going to keep on in the same direction of course, just the way it did in the picture when we saw the barn at the north pole.

"But while the pail *really* and *truly* keeps on swinging in the same direction it started in, it will really and truly change the direction of its swinging on the barn floor too—and—and—well I guess I can't go any farther after all," Betty finished in disappointment.

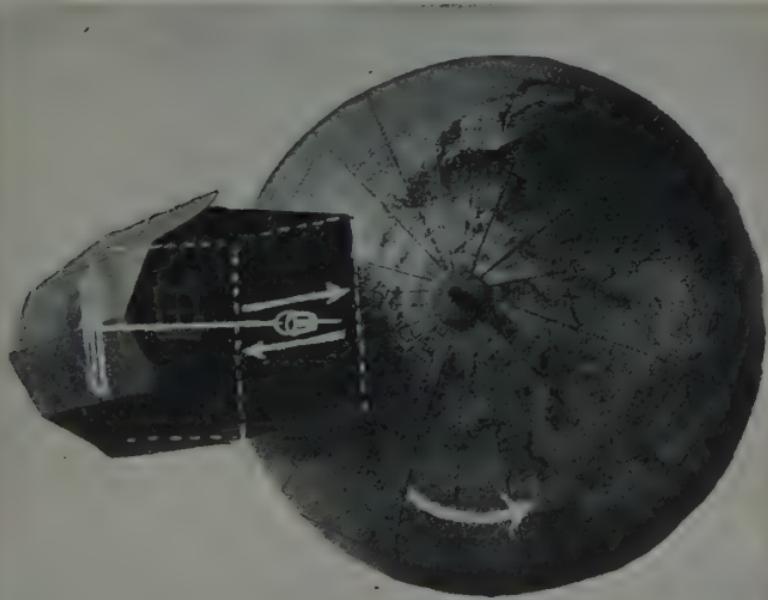
"Think the picture, little lady!" Puck suddenly piped up from the feed box, where he had all this time been practicing at walking on his hands.

"Think of what you want to make them see, and all can then see it on the spider's movie screen."

Betty began at once to think of the picture she had had clearly in her mind, but hadn't been able to find

the right words to draw, and presto—right away the globe appeared again on the spider web!

It was turning slowly round on its axis as before, but the children and Uncle Henry seemed to be looking down on the globe from above its north pole. After the globe had turned completely round once, Grandpa's barn appeared upon it, about halfway between the icy pole and the hot tropical equator—just where Uncle Henry had said it was in reality. The barn was placed with the long way of the floor North and South too. Then, as before, the sides became like glass and the children could see the pendulum-pail swinging North and South, back and forth, North and South, like this:



But, as the globe turned, the leafy twig below the bottom of the pail stopped gliding back and forth exactly along the cracks in the floor boards of the barn floor.

As the pail continued to swing, the twig began to brush diagonally *across* the cracks in the floor—and then, when the globe had turned a part of the way round, the pail was swinging crossways of the barn, like this:



And as the globe continued to turn, the pendulum-pail was soon again swinging lengthways of the barn floor, like this:



When the children had watched the globe go through another part of its turn they saw that the pail was again swinging *crossways* of the floor and when the barn had been carried still farther around, the pendulum was returning to the same North and South direction in which it started.

"Do you mean to tell me," cried Peter in sudden astonishment, "that if we start our old pail of dirt here to swinging North and South, or lengthways of this barn floor, that in a few hours it would be wagging crossways?"

"It certainly would," said Uncle Henry, "the only difficulty in the way of our trying it is that the pail wouldn't keep on swinging that long. It *would* swing

for half an hour or so, but our pail of dirt with its twig is so clumsy that I'm afraid we wouldn't be very successful in seeing the small amount that the barn would turn in that time. If we had a better pendulum, with an accurate metal pointer in the bottom instead of our leafy twig, and if it was hung in a room quite free from drafts of air, we could really try it and could measure the amount the world turns in half an hour."

"Who found out all about this? Did you, Uncle Henry?" asked Betty.

"I wish I had," said Uncle Henry, "for I would now be as famous as Monsieur Foucault, who did it the first time with a heavy pendulum hung from the roof of the Pantheon in Paris. That was over seventy years ago, and since then "Foucault's experiment" has been repeated numberless times in all parts of the world. The closer the place where it is tried is to the equator, the smaller the amount the pendulum turns in half an hour. The nearer to the pole the experiment is tried the faster the swinging weight turns away from the North and South line where it is started. At the North Pole, as we have seen, the pendulum turns completely around in twenty-four hours, but the farther away from the pole it is hung, the more slowly it turns until, at the equator, the pendulum never leaves the North and South line at all. It always works just the same, wherever it is tried, and it is the actual proof that the earth turns on its axis from West to East once every day."

"Tell me, Mr. Puck," said Betty to the little green

man, who still sat cross-legged on the dirt in the pail, “did Monsieur Foucault discover his experiment in a Fairy Ring in France?”

“Yes,” said Puck, “and I told him there just how far the pendulum would turn on the circle on the Pantheon floor in an hour—before he even tried the experiment at all.”

The children looked at Puck quite open-mouthed with wonder. He rose, leaped upward, grasped the wire, and quickly went up it hand over hand to the beam overhead. Then in a moment the pail of dirt fell to the barn floor with a thud and the wire came rattling down after it.

Puck had vanished and Uncle Henry and the children decided to adjourn and go fishing in the creek for the rest of the day. “Foucault’s experiment” is wonderful enough to think about for a whole day. See if you don’t think so.

FIFTH REEL

IN WHICH UNCLE HENRY MAKES A FUNNY KIND OF SUN-DIAL—THE CHILDREN LEARN TO TELL TIME BY THE BIG DIPPER—AND PAUL'S CAMERA PROVES AGAIN THAT THE WORLD TURNS ROUND EVERY DAY

THE next morning Betty was out in Grandmother's old-fashioned garden picking some "bleeding heart" and pretty blue "bachelor's buttons" for the vases in the house, and while she was there Peter and Paul raced in from the barn with "Rags" in tow. They stopped to look at the sundial that stood on the cement post that Uncle Henry had built for the dial, after he brought it a year or two before as a present to Grandma. It was a beautiful, old, brass sundial that Uncle Henry had found in an antique shop in New York. Around the figures in the circle were these words in quaint old letters:

"L'Amor che muore il Sol e l'altre Stelle"

Peter and Paul leaned their elbows on the edges of the dial and saw that the shadow said "nine o'clock." Then they pronounced the words as well as they could and wondered what they meant.

Talking about the pendulum in the barn the day

before had made them more curious about telling time, you see.

Peter glanced over toward the porch of the house and could see Uncle Henry reading a book in the hammock.

“Uncle Hen!” he called.

Uncle Henry sat up and looked out into the sunlit garden. It must have looked inviting to him, with the three children and their dog around the sundial among the sunflowers and marigolds and verbenas, for he closed his book right away and came over to them.

“What is it, Pete?” he asked.

“What do these words mean?” Peter inquired.

“Yes, and what makes the sundial tell what time it is?” asked Betty, who now had picked all the flowers Grandma needed and taken them into the house.

“And please tell me,” said Paul, “how I can take a real good picture of the moon with my Kodak. I tried it ‘fore you came last month and there wasn’t anything but a white streak in the picture when it was printed—and it ought to have been better, ‘cause I exposed the picture for ten minutes.”

Uncle Henry laughed.

“I’ll begin with the first question first,” he said, “because it is the easiest one to answer.

“The words on the sundial are Italian and they mean,

‘The Love that moves the sun and the other stars.’”

The children were quiet a moment before Betty said,

“I like that. It’s beautiful—like poetry—and some of Mamma’s songs—like, ‘The night has a thousand eyes.’”

“But *is* the sun a star?” inquired Paul.

“Yes,” Uncle Henry assured him, “it is just the same kind of a star as those you see at night, except that we are much nearer to the sun, so it looks very much brighter. Some of the far-away stars are much bigger suns than ours.”

“Well,” said Paul, “it’s a good thing we *are* near to the sun, ‘cause if we weren’t, this sundial wouldn’t work at all, and I like to watch the shadow creep. You can almost see it move. Why *does* it tell time, Uncle Hen?”

“Well,” said Uncle Henry, “I move that we go out into the Fairy Ring and wonder about it. Perhaps if we think hard enough Puck will come and help us to find out all about telling time.”

“That’ll be great,” said Peter.

“It might be a good plan to take your Scout’s compass, a wooden barrel or cheese-box hoop, about a yard of lath, a hammer and some little nails, and plenty of strong string along,” suggested Uncle Henry. “They might help us to think better. Oh, yes, and we’ll have to borrow Rags’ white rubber ball from him too.”

Peter went to hunt lath, nails, hammer, and string; Paul went to find an old barrel hoop; and Betty started in search of Rags’ ball. They were

all to meet in the Stump Meadow by the Fairy Ring in fifteen minutes.

When Uncle Henry found the children there he had also one of his big pads of drawing paper with him, and a mysterious little, flat black box.

Uncle Henry sat on Puck's stump and the children sat around him on the grass inside the mushroom ring.

"Pete," said Uncle Henry, "have you got your jackknife with you?"

"Sure!" said Peter.

"All right. Cut this wooden hoop into two half circles," commanded his Uncle.

When the hoop was cut, Uncle Henry showed Peter how to cross the two half hoops at right angles and tie them with heavy cord at the middle. Then he tied the cut ends of one of the half hoops together with a heavy cord, as if it was a bow, and the two hoops looked like this:



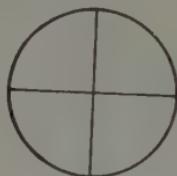
"You remember," said Uncle Henry, "that the globe you have in the playroom at home turns round on its axis, just as the earth does?"

The children remembered very well indeed.

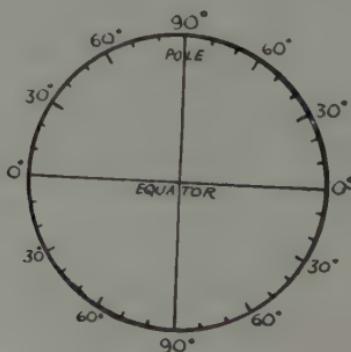
Uncle Henry then opened the fascinating little black box he had brought. It proved to contain a set of drawing instruments—compasses and everything.

In a moment the compasses had made a circle on the drawing pad and Uncle Henry had drawn a vertical line through the centre of the circle.

Then he drew another line through its center. This was at right angles to the first line, and the two divided the circle into quarters, like this:



Uncle Henry then divided each quarter into thirds and each third into smaller thirds. After the figure 90 was written at each end of one of the lines and 0 at each end of the other, the circle looked like this:



"Every circle," said Uncle Henry, "is divided into four quarters, and each quarter into ninety small, equal parts or 'degrees.' Four times ninety is three hundred and sixty degrees for each complete circle.

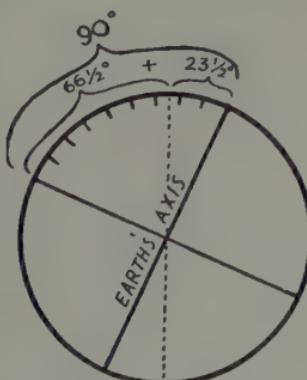
"Now if the earth stood up and spun around the sun with its axis parallel to the sun's axis (for the sun revolves like a top too) it would be like this:



"But instead of doing that the earth's axis slants twenty-three and one half degrees away from the vertical, like this:"

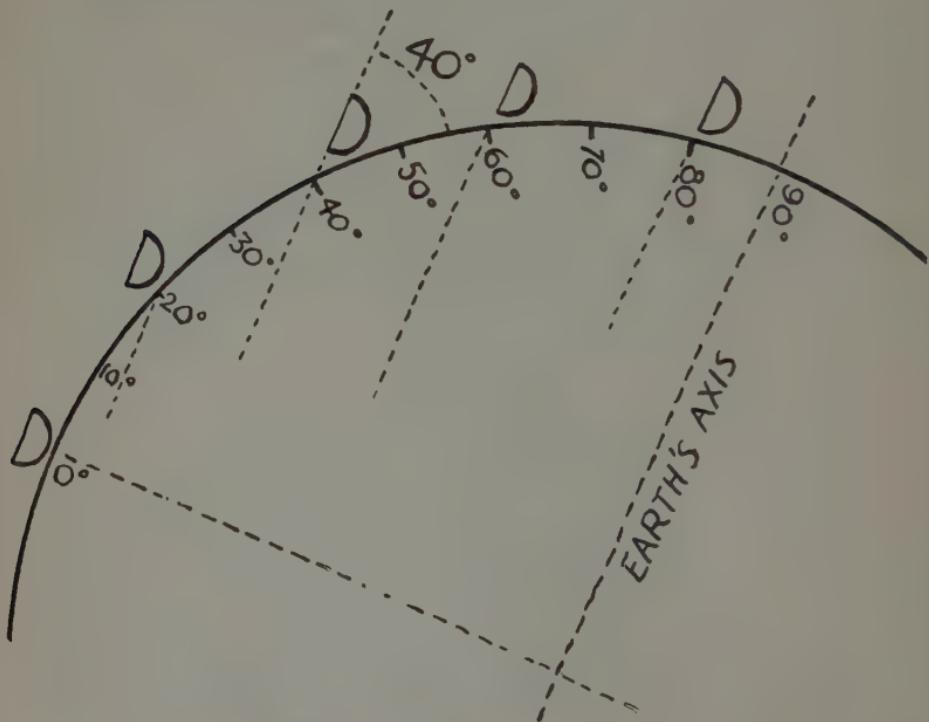


This shows how much twenty-three and one half degrees is.



"This slant of the earth's axis away from the line of the sun's is the cause of our having warm Summers and cold Winters. We'll find out about that some other time. Just now we want to find out what makes the sun-dial tell time."

Uncle Henry then drew the quarter circle that lies between the equator and the pole of the earth larger, and at intervals of twenty degrees along the curve his compasses drew small half circles with straight lines joining the ends of the bows. These short lines were all parallel with the long line representing the axis of the earth. This was how the drawing looked:

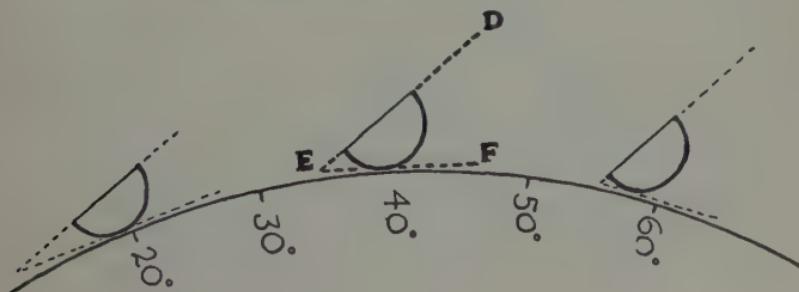


"We found out yesterday," continued Uncle Henry, "that here on your Grandpa's farm we are about half the distance between the earth's equator and pole. To be exact we are just four-ninths of the way, or just forty of the ninety degrees away from the equator. Astronomers would say that our farm is at 'forty degrees north latitude.' Now, Paul, show us how we ought to place our barrel-hoop sundial on Mr. Puck's stump here, so that the stretched bow cord will be parallel with the earth's axis."

Uncle Henry got up from the stump and handed the barrel hoops, tied together, to the little boy.

Paul looked carefully at the drawing of the little circular bow at the point in the big quarter circle where the figure 40 was placed, and put the barrel hoop on the stump so that the stretched cord made the same angle with the ground as the line representing the cord did with the curve of the earth in the picture.

These next two pictures show how the angle ABC is the same as the angle DEF:



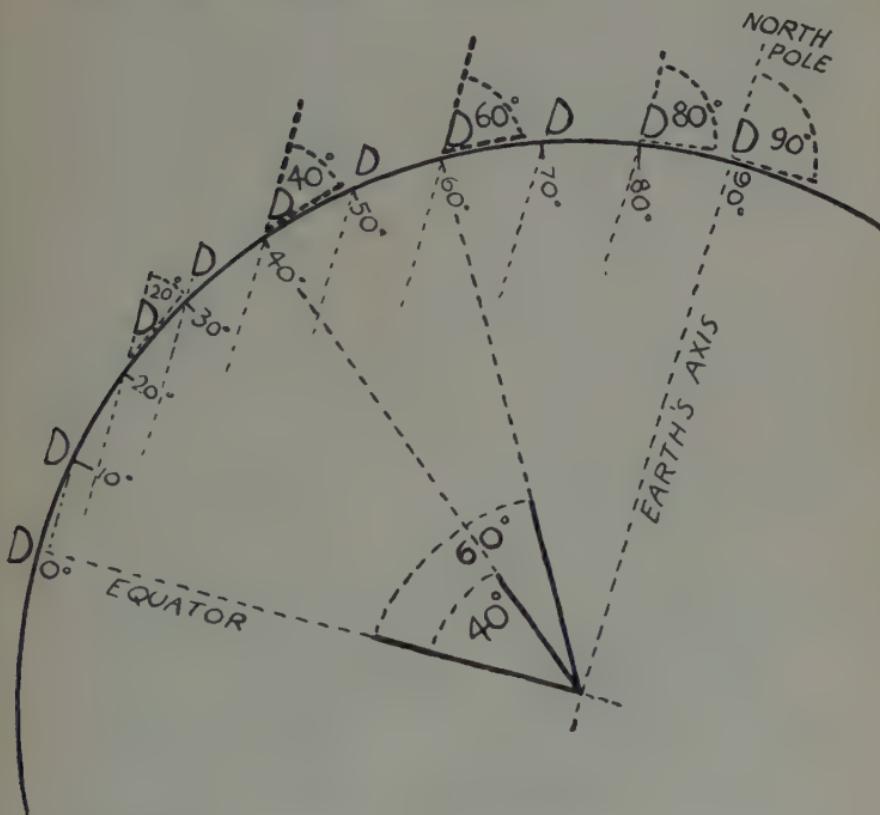


"If we lived at sixty degrees north latitude instead of here," said Paul, "the line of the cord would tip up more, wouldn't it?"

"Yes, and that reminds me of something else," said Uncle Henry. "I can show you with the compasses more quickly than I can explain it."

The little compasses started to work once more and Uncle Henry showed, with the aid of parts of dotted circles added to the large picture of the quarter circle, that the number of degrees in the

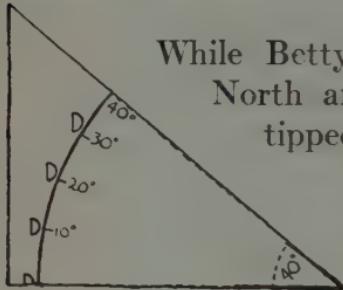
angle the cord made with the ground was always the same as the number of degrees of latitude of the place. This shows it better than words:



When the children all understood that the cord of the bow in the barrel-hoop sundial must always be parallel to the axis of the earth, Uncle Henry said,

“Now we must do just one more thing before our sundial will be ready to tell time. Paul, bring the Scout’s compass and lay it on the stump so we can see where the North is.”

Paul did, and Uncle Henry turned the bow of the hoop until the cord stretched upon it pointed in the same direction the magnetic needle did. Then, while Betty held the hoop motionless, Uncle Henry cut away the big quarter circle he had drawn on the paper until only a V-shaped piece was left. The angle at the point of it was an angle of just forty degrees, like this:



While Betty held the barrel hoop in a North and South position, Paul now tipped it until the V-shaped piece of paper just fitted into the angle between the cord and the stump, like this:



Then Peter nailed the barrel hoop firmly to the

stump and the dial was properly adjusted to tell time at the point on the earth's surface where Grandpa's farm is located—forty degrees north latitude.

"If we come out here to-night," said Uncle Henry, "and sight along the cord, from the bottom end toward the top end of it, we shall find that we are looking straight at the north star, which is called *Polaris* because the polar axis of the earth points at it."

"You see that *Polaris* is so far away that the thickness of the earth is nothing in comparison to the immense distance, so any line parallel to the earth's axis will also point to *Polaris*."

By the time the children and Uncle Henry had their barrel-hoop sundial finished and adjusted Uncle Henry's watch said that it was noon.

The shadow of the cord then fell across the middle of the "crossways hoop" and along the inside of the "bow hoop," like this:



"Ooh!" cried Betty, "*now I see what the cross-ways hoop is for!*"

"What *is* it for?" asked Uncle Henry, smiling with pleasure, as he always did when the children discovered things for themselves.

"Why, it's to catch the shadow in the morning and afternoon. The arm of the hoop toward the West catches the shadow of the cord in the morning, and the one toward the East catches it until sunset."

"Quite right" agreed Uncle Henry, "and since you've discovered it, Betty, we'll let you take this piece of chalk and mark the hours on the inside curve of the 'crossways hoop.'"

Uncle Henry had produced a piece of white chalk from one of his always surprising pockets, and showed Betty how to divide off each arm of the "crossway hoop" into six equal parts or hours.

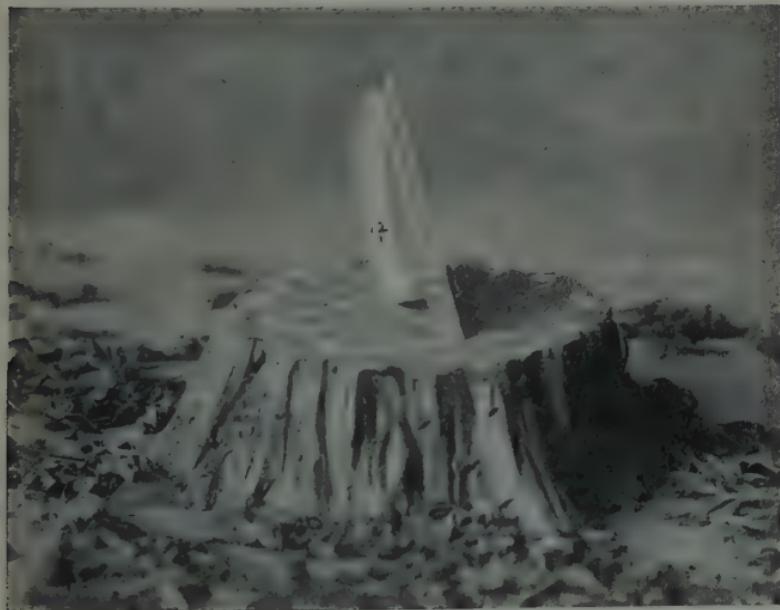
This is the way the sundial looked a little later in the afternoon when the shadow of the cord crossed the East arm of the "crossways hoop" at about the three o'clock mark.



"Why," asked Paul, "is the sundial in Grandma's garden flat, while the one of ours is round?"

"This one would be just the same as your Grandma's," said Uncle Henry, "if we cut off the arms and then took that triangle of paper we used to find the right slant of the cord, and fastened it upright under the cord."

This picture shows these things, and also that the figures for the hours would have to be put in the flat top of the stump instead of on the arms of the hoop.



By this time the children knew that it was dinner time without any assistance whatever from sundials of any kind, so the meeting adjourned, leaving the sundial on the stump to count the hours until the children should come back to it again.

Steadily and smoothly the earth turned from West to East, and just as steadily the shadow of the cord traveled along the inside curve of the Eastern arm of the dial, until the sun seemed to sink in the West and Luna Moon, now almost half full, appeared in the sky.

During the afternoon Uncle Henry showed the children this picture of the largest sundial in the world. It was built in India by a powerful Rajah nearly two hundred years ago. The half circle where the shadow falls is one hundred feet in diameter and the slanting wall that casts the shadow is ninety feet high. The shadow moves in the curved surface at the rate of two and one half inches every minute.



From Astronomy; A Popular Handbook, by Harold Jacoby, The Macmillan Company.

It was quite dark when a little procession, headed by a young man with a barn lantern, left the farmhouse and started for the Fairy Ring in the Stump Meadow. Paul carried a school slate and had chalk in his pocket.

"Our sundial will be asleep now," said Betty.

"Yes," said Peter, "but it'll wake up the moment the sun comes up."

"How would we be able to tell time at night, Uncle Hen," asked Paul, "if we didn't have any clocks or watches?"

"Just the same way people told it at night before there were any clocks or watches," said Uncle Henry.

"But how was that?" persisted Paul.

"By the big clock in the northern sky," said Uncle Henry.

The children tried to see his face to find out if he was joking, and when they saw that he wasn't they looked up at the northern stars with puzzled expressions.

By this time they had all arrived at the Fairy Ring and Betty cried,

"Oh, I want to find *Polaris*, the north star, the way Uncle Henry said we could this morning."

So the little girl lay down on the sod and looked upward and Northward along the line of the sundial's cord.

"It really does do it!" she cried.

"Does do what?" said Peter.

"The cord really does point out the north star,"

cried Betty. "I know it's the north star because the pointer stars in the big dipper show that it is."

"Yes, that's right," said Uncle Henry, "and the north star is the place where the hands of the star clock are fastened on. It is the centre of the dial, that never moves, the point that all the other stars in the northern sky swing around in circles, once every twenty-four hours."

"How do people know that?" asked Peter.

"Well, one good way to know is to take a photograph of them doing it," said Uncle Henry. "Paul wanted to take another picture of the moon because the last time he tried it he got only a black streak on the plate. That was a *good* picture instead of a bad one, for it told the story of the earth's turning on its axis. So now, instead of another picture of the moon, I propose that we point the Kodak at the north star and let it be telling its true story silently on the sensitive plate for an hour or so, while we talk about the great star clock up there, and learn to tell time the way the shepherds with their flocks did, centuries ago, before watches were ever even dreamt of."

"Ooh, that'll be great!" exclaimed Betty. "Let's start the Kodak to work right away, and when we get back to the house Peter can develop the plate and see what the north star's story is."

Uncle Henry focused the Kodak for a "distant view" and propped it up on the stump so that it pointed upward, parallel to the line of the cord on the sundial, like this:



Then he carefully opened the shutter for a time exposure and let the camera stand where it was.

"Now we can forget the Kodak," he said, "it will keep right on doing its work, and will tell us all about it later on. Everybody find the big dipper now, and we'll soon be able to tell time by the stars at night, just the way we do with our sundial in the daytime."

The children had all found the big dipper now and Betty said,

"It's hanging down by the end of its handle, just as if it was on a nail."

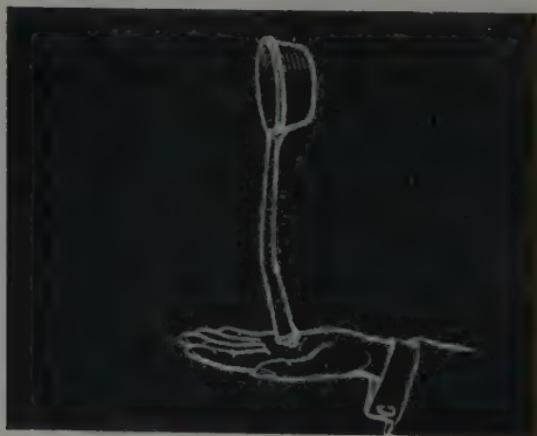
"Yes," said Uncle Henry, "the dipper is like that in the evening in Summer, and since it is now just about July first and about nine o'clock in the evening, the dipper is hanging down very straight

from the end of its handle, with its bowl just at the left of the pole star."

This shows how the children saw the big dipper, or great bear.



Then Uncle Henry explained that the dipper was just on the opposite side of the pole star in the Winter, on January 1st at nine P. M., but standing on its handle like this:



It's just as if some juggler was balancing the handle on his hand or on the end of his nose!" cried Paul.

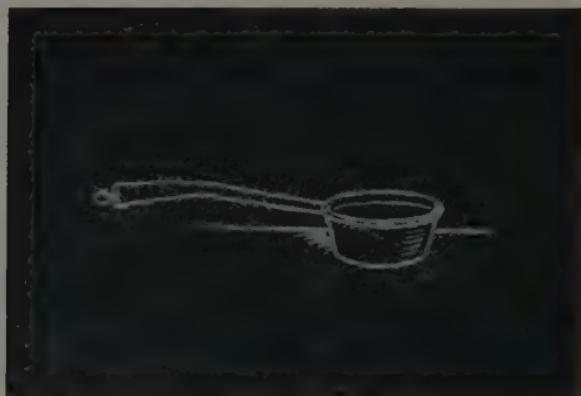
"Precisely," agreed Uncle Henry.

"Now we'll see," he went on, "how the dipper looked in Spring, say on April first, at the same time in the evening."

Here Uncle Henry took the slate from Paul, and drew, by the light of the lantern, both the Summer and Winter positions of the dipper, and after them the Spring and Autumn ones. In Spring it was upside down with the water all spilled out, like this:



But in Autumn the dipper was standing solidly on the bottom with all the water safely held in it, like this:



"Oh," cried Betty, "I begin to see where the hands of the star clock are, but they tell *months* instead of hours."

"That's fine!" said Uncle Henry enthusiastically. "show us with this pencil," and he handed the chalk and slate to the little girl.

Betty then drew the dipper in each of its four positions, but she put all of them in one picture, like this:



"That's the clock's face," said Betty, "but I don't know where to put the hour figures and the hands."

"This clock has no minute hand," said Uncle Henry, "just an hour hand. As for the figures, we'll find out about them right away."

Then Uncle Henry put the figure 9 just beside the dipper in its Summer position, and drew in a clock hand pointing to it.



"Now," said Uncle Henry, "our star clock is right; it says 'nine o'clock, July 1st.' Who can tell me where the hand will point at midnight to-night? Remember that our clock turns from right to left, just opposite to the way our ordinary clock or watch does."

"Why is that, Uncle Hen?" asked Peter.

"You know if you stop and think a moment," said Uncle Henry.

The children thought a minute or so and then Paul said, "I know."

"Well then," said Uncle Henry, "tell us why."

"I'll try," said Paul. "The right of the north pole star is East and the left if it is West, so if the clock hand turns from right to left it turns from East to West. But it only *seems* to turn because the earth is always turning from West to East, just the opposite way."

"Very good, indeed," praised Uncle Henry, "now perhaps you can go on and tell us where the clock hand will point at midnight to-night. Draw it on the slate when you have made up your mind."



Paul promptly drew the hand pointing straight downward, like this:

"Your mistake is very natural," said Uncle Henry. "Three hours on a watch dial *is* a quarter way round, but remember that the hands on a watch must travel *twice* round the dial every twenty-four hours. Remember too, that our star clock hand turns only *once* round in twenty-four hours. Then try again."

Paul thought this over and then drew the position of the hand at midnight only half as far advanced beyond its nine o'clock position.



"I see," cried Peter, "it goes a quarter way round every six hours, and four times six are twenty-four!"

"Quite true," smiled Uncle Henry, "so now you know how to tell time by the great star clock."

The children had not thought it was quite as simple as that, so they weren't sure whether they knew how or not.

"Try us some way and see if we know," said Paul.

"All right," Uncle Henry agreed, "you already know the nine and twelve o'clock positions for this month, July. Now I'll draw the hand in another position and you see if you can tell the time of night it would be if you saw the dipper in the same position up there in the sky."

"That'll be fine!" cried Betty, "it's a new game to play!"

So Uncle Henry drew the dipper and imaginary clock hand in this position.



"What time of night would it be if the dipper was like that, right under the pole?" asked Uncle Henry.

After a little thought the children all agreed that it would be three o'clock in the morning, since the hand had moved a quarter of the way around the dial, and a quarter of twenty-four was six, and six hours after nine P. M. was three A. M.

Then Betty said, "But, Uncle Henry, "the hand

of the clock points the same way at three o'clock in July as it will at nine o'clock next October."

Uncle Henry was pleased.

"That's fine, Betty," he said. "You've discovered that the dipper is not only a clock, but a calendar as well. People in old times used the other stars and the dipper as their only calendar.

"Before clocks and watches made them forget how to do it, everybody knew how to tell time by the stars, too. Even as recently as Shakespeare's time lots of people did. In his play "King Henry the Fourth," one of the wagoners in the Rochester inn-yard scene says,

'Heigh-ho! an' it be not four by the day, I'll be hanged; Charles' Wain is over the new chimney, and yet our horse is not packed!'"

"What is Charles' Wain, Uncle Hen?" asked Paul.

"It's the same as the big dipper with us," explained Uncle Henry. "In England they call it Charles' Wain. This will show you why."

Then Uncle Henry drew this little sketch to show how the dipper obligingly becomes Charles' Wain, or wagon, when English people look at it.



"Well," said Paul, "I'm going to get so I can tell time by the dipper clock any time of night and any time of year."

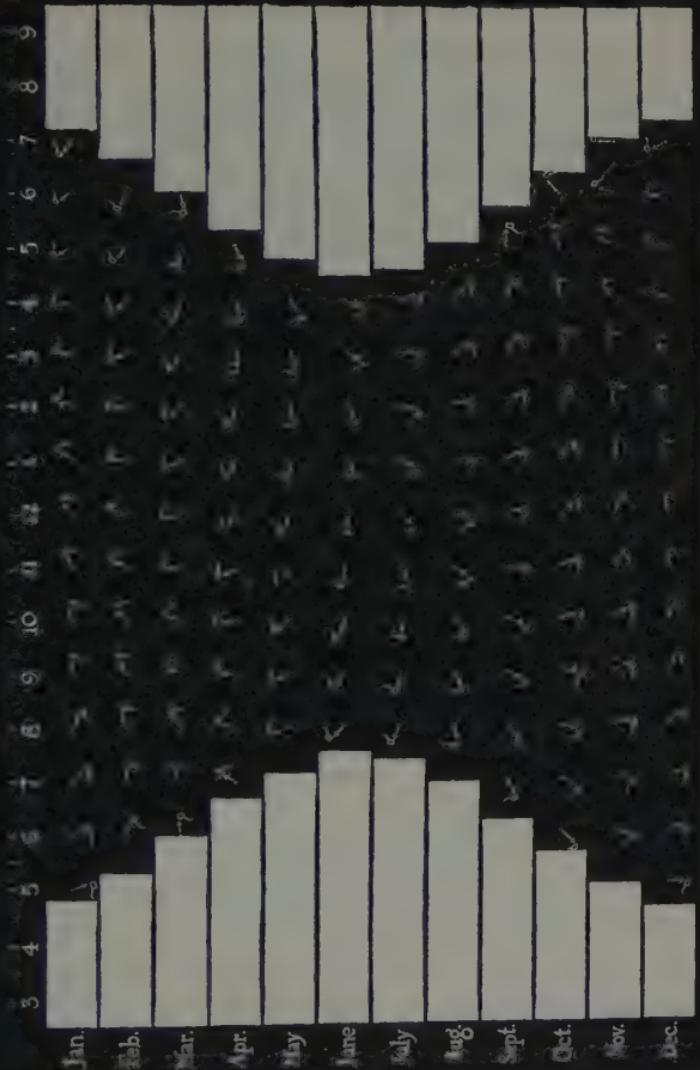
"Me, too!" echoed Peter and Betty.

"It's very easy," said Uncle Henry. "The position of the clock hand at nine o'clock in February is just one-twelfth of the way farther round than its January position, going the opposite way a watch hand does. In March the nine o'clock position is another twelfth of the way round and so on through the year. Then, as soon as you know the hand's nine o'clock position for any month, it is easy to see that at two, three, four, five, or six hours later the hand will have moved two, three, four, five, or six twenty-fourths of the way round from right to left."

The "moving picture" of the great star clock's hand and the dipper on the next page shows their position for every month in the year and for every hour of the night. You will see that in the long winter nights of December the clock hand is visible almost three-quarters of the way round, while in the short summer nights of June it can be seen through less than half a complete revolution.

When Uncle Henry and the children had looked at the star clock and talked about it as long as they wanted to, they closed the shutter of the camera and all trudged back to Grandfather's farmhouse, but Peter and Paul insisted on sitting up while Uncle Henry developed the plate that told the stars' story of the earth's rotation around its axis.

How the Star Clock Tells Time



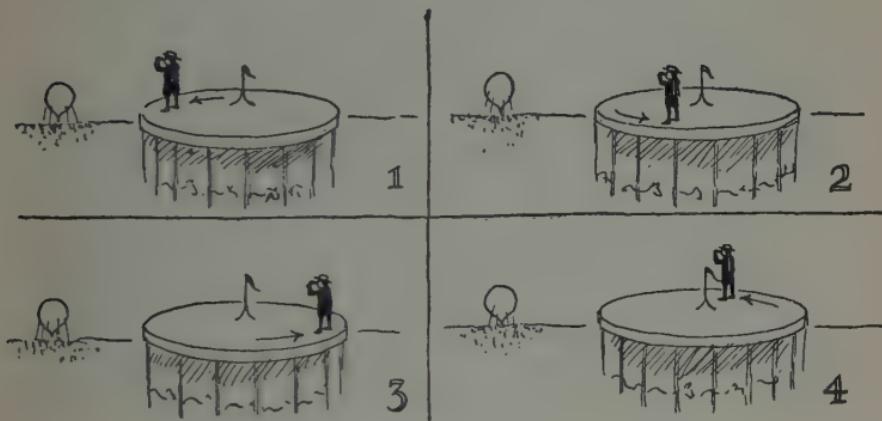
Next morning they made a print from the negative and it looked like this:



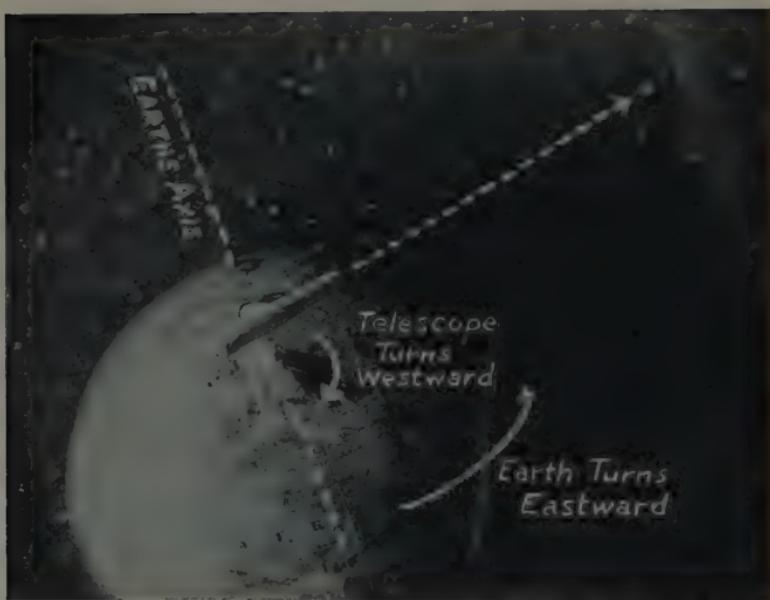
You see the stars of the dipper made long circular trails, while the pole star remained almost still at the centre of all the curves. Since the picture was exposed for only an hour the curves were only one-twenty-fourth of complete circles, as the earth had turned for only one of the twenty-four hours while the picture was being exposed.

These four little pictures show that if a boy stood on the roof of a merry-go-round while it was running, and wanted to keep an opera glass pointed at the balloon ascension too, he would have to keep

turning himself every moment to avoid turning his back on the balloon. The boy turns around on his own axis, which is parallel to the axis of the merry-go-round.



Now imagine that the revolving world is the merry-go-round and that the big telescope, turning on an axis that is parallel to the axis of the earth, is the boy with the opera glass. Then, when you have looked at these next two pictures a moment, you will see how an astronomer is able to keep a big telescope continually pointing at the same star as long as he wants to look at it. The earth keeps turning from West to East and the telescope keeps turning the opposite way, from East to West—so it keeps on pointing at the star, just the way the opera glass of the boy riding on the roof of the merry-go-round kept on pointing at the balloon.



The next picture is a photograph of the Yerkes telescope, the largest of its kind in the world. It keeps pointing at any star that the astronomer wants to look at, because it turns round on a slanting axis that is exactly parallel to the polar axis of the world.



The camera that Uncle Henry propped up on the stump to take the picture you have just seen—the stars around the pole—was a Kodak with a “rapid rectilinear” lens. If you want to take a similar one, be sure to open the “iris-diaphragm” of the lens as wide as it will go. You will not get a good picture unless the stars are very clear and bright—and the moon must be out of the sky. When it is moonlight the camera can not see the stars any better than you can.

If you happen to have a camera with an “anastigmat” lens (F 7.5, F 6.3, or larger) you will get a still better picture than the “rectilinear” lens will make, because the “anastigmat” lens will let in more light from the stars.

If you have no camera, you can make one that will take quite good star pictures. Take an ordinary reading glass, cut a round hole, about an inch in diameter, in the end of a cigar box, and fasten the reading glass over the opening. Then open the lid of the cigar box, hold a white card inside and watch the picture that the reading glass throws on the card when you point the lens at a distant tree or building.

Mark the place where the picture is clearest. Put a card-board partition in the box at this place. Then, when night comes, go into a dark room and lay a glass photographic plate on the partition, with the film side toward the lens. Close the box carefully and cover up the reading glass with your cap or any other handy piece of dark cloth.

Now you are ready to take the picture. Go out doors and prop up your box camera so that it points toward the pole star. Then uncover the lens and leave it for an hour. Cover the lens with the cap again and take the camera, with the plate inside, to be developed.

SIXTH REEL

THE CHILDREN GET ACQUAINTED WITH OLD SOL'S FAMILY—AND FIND VENUS, MARS, AND THE EARTH GROWING IN A PEA POD

THE next morning at breakfast Grandmother told Peter and Paul that they might go out to the garden, pick a nice watermelon, and put it down in the cool cellar until dinner time.

“Your Uncle Hen,” she said, “will go along and tell you which are the ripe ones.”

So the children all trooped out, with Uncle Henry bringing up the rear, and for a few minutes they were all thumping the melons to find the ripest one.

“They’re not quite as round as the geography globe, are they,” said Betty, “but the stripes coming together at the stem ends make me think of it.”

“They *are* rather like the meridians coming together at the pole of the globe, aren’t they?” Uncle Henry agreed.

He thought a moment, looked off across the field beyond the garden, and then said,

“I’ll tell you what we’ll do, youngsters, if you feel like it. After Pete and Paul have taken this melon we’ve selected down into the cellar we’ll start with that other big melon over there—the really round one with the stem right on top—and play a game called ‘Old Sol’s Family.’”

"Ooh, great!" cried Betty. "We're in Old Sol's family too, aren't we?"

"Yes, and I wonder if you can tell who all the brothers and sisters of our world are," said Uncle Henry.

"Well," said Paul, "I know *Mars* is one of them."

"*Saturn* too!" added Peter, "with his rings. I've seen 'em in pictures lots of times."

"All right," laughed Uncle Henry, "run along down in your Grandmother's cellar with the melon for dinner and Betty and I will guard our 'Old Sol' here on the ground until you get back."

When the boys returned Paul said,

"You mean the big round melon is going to stand for the sun in our game?"

"Exactly," said Uncle Henry. "This melon is about a foot and a half thick and nearly round, so he'll do for Old Sol very nicely."

Then Uncle Henry took a bit of stick and began scooping out the soft dirt beside the big watermelon. He kept on until he had a round, cup-shaped hole big enough to hold the melon up to its middle. Then he placed the big melon in the hole and leveled the dirt smoothly all the way round, like this:



"What's that for, Uncle Hen?" asked Paul.

"Well," said his Uncle, "all of Old Sol's family revolve around him in circles at the same level or 'plane,' and this plane goes through the equator of the sun—just the way the level of the ground here in the garden goes through the center of our half-buried melon. So we'll let the top of the level ground represent the 'plane of the ecliptic,' as astronomers call it."

"What does 'ecliptic' mean?" inquired Betty.

"It comes from the word 'eclipse,'" said Uncle Henry, "and sometime we will see how eclipses, either of the sun or moon, must always occur in the 'plane of the ecliptic.'"

"Well," said Peter, "we started out to find Old Sol's family; where is the first member?"

"Over there in a green pod hanging on the pea vines; you can pick it and bring it over here if you like," said Uncle Henry.

"In a pea pod?" cried Betty in astonishment.

"Certainly," said Uncle Henry, "*Mercury* is the littlest brother in Old Sol's family of planets, and compared to his father, the sun, represented by our big watermelon here, *Mercury* is the size of a very small pea indeed. Let's open the pod Peter has there and see if we can find one small enough. Our *Mercury* should really be a little smaller than a double B shot, such as you use in your air-rifle."

"Oh, I've got some BB shot in my pocket. Here's one," said Paul.

"That's fine," said Uncle Henry. "Now you

run into the barn, Peter, and get your Grandfather's long tape measure out of his tool chest. We want to know how far to put little brother *Mercury* away from his father, the sun."

When Peter came back with the tapeline, Uncle Henry asked Betty to hold the end on the stem of the big "sun-melon." Then he ran out the tape as he walked away toward the Stump Meadow. He kept on going so far that the children thought there must be some mistake and Peter said so.

"No," said Uncle Henry, laughing, "this 'Old Sol's' family of *ours* is going to be in the right proportions. Some of the pictures of the solar system you see in atlases and geographies give you entirely wrong ideas about the sizes of the planets, and their distances from the sun. The planets are often shown both too large and too close to the sun. Our BB shot, or *Mercury*, needs to be 62 feet from the "sun-melon" in order to show the right proportional distance of the real *Mercury* from the sun."

So Paul put down the BB shot and stuck up a twig in the dirt to mark the place.

"I wonder," said Betty suddenly, with a note of anxiety in her voice, "what has become of Mr. Puck? We didn't see him all day yesterday. I wonder if he got offended about something."

"It's like this," said Uncle Henry, "Puck has to bring so many answers to people in Wonder Rings everywhere that he's terribly busy all the time. So as soon as you get to be able to answer some of your questions yourself he lets you do it. You'll find

that when you really need Mr. Puck's help again he'll appear, just as suddenly as he did the first time. You'll find too that the more questions about everything that you figure out yourself the more you'll be able to."

"Well," said Peter, "Puck or no Puck, let's go on to the next of *Mercury's* brothers. Or maybe it's a sister. Is it?" he asked Uncle Henry.

"Yes, it *is* a sister this time. Only one girl in a family of eight though—unless you want to include our own earth as a lady."

"I think we'd better," said Betty, "because people talk about 'Mother Earth' you know."

"Quite right," said Uncle Henry. "Well, then, let's go ahead and find *Venus*, the daughter of Old Sol who is just beyond *Mercury*, between him and 'Mother Earth.' Peter, give me that pea pod you picked."

"Peter Piper picked a pea pod!" sang Betty.

"Yes," said Uncle Henry, as he snapped the pod open, and picked out two small peas of almost the same size, "and the pea pod Peter Piper picked had *Venus* and the *earth* both in it."

"Are they really as much alike as that?" asked Betty.

"Yes," Uncle Henry assured her, "as far as size goes, *Venus* and the *earth* are as alike as two peas."

"How big is *Mars*?" asked Peter.

"Here is *Mars*," said Uncle Henry, as he selected a pea a little over half the size of the one representing the earth and Venus.

"Come on," said Paul, "let's see how far beyond *Mercury* we have to go before we put down *Venus*."

Uncle Henry ran out the tapeline again while Betty held the end of it at the point where *Mercury*, the BB shot, was placed. After 62 feet of the tapeline was out Uncle Henry stopped and said,

"Bring *Venus* here, Peter. It is 124 feet from the melon where the orbit of our twin sister pea is."

Peter brought *Venus*, set it on the ground, and stuck another twig up beside the pea to mark the spot.

"Forward march again!" cried Uncle Henry, so Betty held the end of the tapeline beside *Venus*, and the tape was run out 62 feet more.

"I know what to do now," said Peter, and put the other pea of the same size as the one used for *Venus* down where Uncle Henry had stopped.

"There is our 'Mother Earth,'" said Uncle Henry, smiling at the pea on the ground. "Better mark it with another piece of stick, Paul, or we may lose sight of it entirely. Our world seems big to us, but it is just a pea in comparison with the big, circular path in which it travels round its father, the sun. It's no wonder we are a whole year in whirling completely round our circular path, is it?"

Then Uncle Henry marked on the ground to show how many times its own thickness the world traveled along its path every hour.

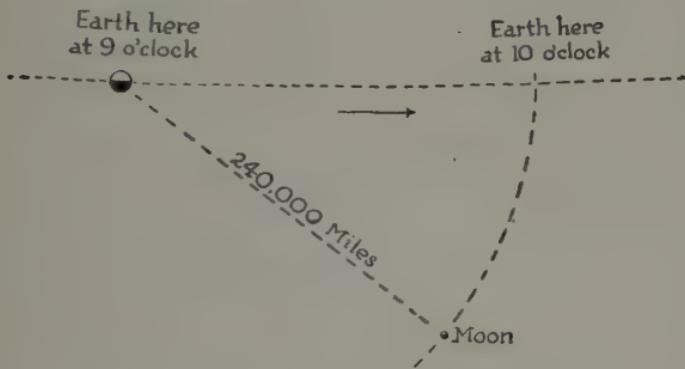
"It is nine o'clock now," he said. "At ten o'clock the earth will be thirty times its own thickness,

which is about 8,000 miles, along its path toward Autumn. How many miles is that?"

Peter was good at figures and said "240,000 miles," right away.

"Yes," said Uncle Henry, "and that happens to be just about the distance of our moon from the earth. Let's find a tiny stone, only about a quarter the diameter of this pea, and place it at the right distance from 'Mother Earth.'"

This shows how the earth and the moon looked when this was done. The mark on the earth's path shows the distance the world travels, with the moon in tow, in one hour.



"Now, let's find *Mars*," cried Peter, "I saw a picture in one of papa's books and it was a map of *Mars*, and it said there were 'canals' on it—like the Panama Canal, I s'pose."

"Nobody knows for sure about the canals yet," said Uncle Henry, "but I'll show you some other interesting things about our little brother planet, after we find out where all the rest of Old Sol's

family are located. They have all been small so far, and *Mars* is even smaller."

Uncle Henry selected a pea from Peter's pod, a little over half the size of the "earth-pea" and it was duly deposited 93 feet farther from the "earth."

"The next member of our family of worlds is different," said Uncle Henry. "*Jupiter* is the next, and he is a lot bigger than *Mercury*, *Venus*, and the *earth* all put together. We're going to need something bigger to represent him. Let's see—how about a green tomato? I guess that will do. Paul, pick a green tomato about one and three-fourths inches across and bring it along. We're going to make a big jump now, for it is a long, long way from our earth to *Jupiter*."

It was a long way, for while Betty held the end of the tapeline beside the pea-earth, Uncle Henry went farther away, and farther, unrolling the tape as he went. The tapeline ran all out and Betty had to go forward to the end of it and hold the end there while Uncle Henry went a long way farther on. They had gone over 650 feet from the "pea-Mars" before he called to Paul to bring the green tomato and set it down.

By this time the children and Uncle Henry were 930 feet from the melon that stood for the sun. They were away out of Grandfather's garden, out nearly across the ten-acre pasture, on the way to the Stump Meadow.

"My," said Peter, "if the sun looks as small from

Jupiter as the melon back there does from this tomato here, I'd hate to live on *Jupiter*."

"You would get very little sunlight and not much heat, that's sure," Uncle Henry agreed.

"How much farther is the next member of Old Sol's family?" asked Betty.

"Oh, about 830 feet," said Uncle Henry. "I'm glad you mentioned it, for we'll need another small green tomato—a baby one—to represent *Saturn*, the next planet."

Paul ran back into the garden and brought one about an inch and a half across.

"That'll do fine," said Uncle Henry, "let's measure off the distance and put *Saturn* where he belongs. Did you set up a stick beside *Jupiter*, so that we can find him again, Paul?"

Paul had.

Then Uncle Henry and Betty used the tapeline again and found the place for *Saturn*, away out in the centre of the Stump Meadow, over 1760 feet, or a third of a mile, away from the sun melon in Grand-father's garden.

The place for *Saturn* just happened to be right close to the Fairy Ring, so when *Saturn* was set down on the ground in his right place, the children and Uncle Henry sat down on the grass in the Ring to rest a little.

"How many more children has Old Sol?" asked Peter.

"Two," said Uncle Henry, "and if we want to go on and put them in their proper places, we can repre-

sent them by two marbles, each about half an inch in diameter."

"How far are they from *Saturn*?" asked Paul.

"Well," said Uncle Henry, "the spaces between the planets get wider and wider the farther you go from Old Sol. The next planet, called *Uranus*, would be a whole third of a mile farther beyond *Saturn*, and if we wanted to put *Neptune*, the last planet, in place, we should have to keep going until we were 300 feet more than a mile from the 'sun-melon' back in Grandpa's garden."

"My," cried Betty, "let's just pretend we've done those two."

"Shall we?" asked Uncle Henry of the two boys.

"Sure," they agreed.

"All right," said Uncle Henry, "and in place of doing that I'll tell you what we'll do. We'll play 'Old Sol's movies.' It's a game that will show us how Old Sol's children move in the sky over our heads."

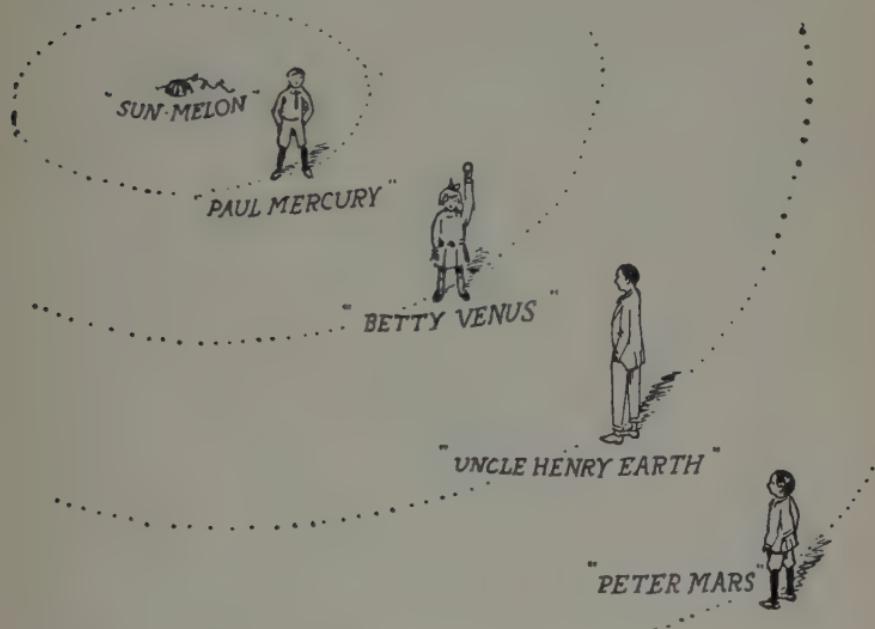
"Fine!" cried all the children, "how do we start?"

"We start by being named," said Uncle Henry. "Peter, you are *Mars*; Paul, you are *Mercury*; Betty shall be *Venus*; and I'll be the earth. Now we'll all go back and find the BB shot that stands for *Mercury*, and the three peas that stand for the others. When we've found them we'll each stand in the spots where they are. Then we shall see what we shall see."

"*Mercury*," "*Venus*," and "*Mars*" jumped up

and raced off back toward the garden, while "Uncle Henry Earth" followed as fast as he could.

When he arrived at the place where the twig marked the place of the "pea-earth," the children all had found their stations. If you could have looked down upon the garden from above, the children and Uncle Henry would have looked like this, except that they would have been a good deal farther apart.



The dotted circles show the paths the planets travel around the sun.

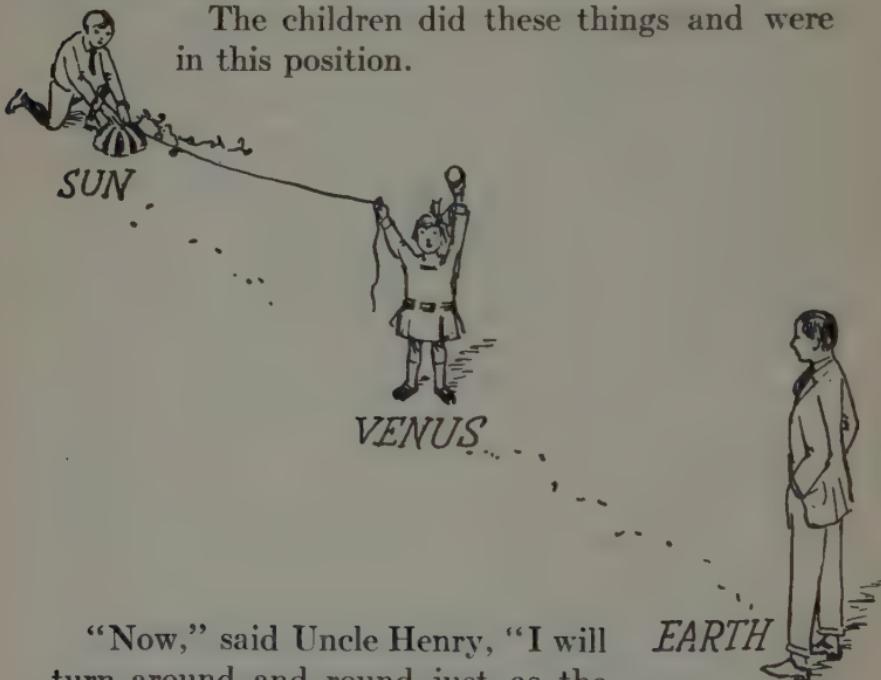
"Betty," called Uncle Henry, "do you know the name of the bright star you saw in the west every evening last spring, just after sunset? It came into

sight almost before the glow was gone from the sky."

"The evening star," Betty called back from her place in *Venus'* position.

"Yes," said Uncle Henry, "it was the 'evening star,' but its right name was *Venus*. Paul, you leave your position as *Mercury* a little while. Give Betty Grandfather's tapeline and the ball you have in your pocket. Now you take the other end of the tape and hold it on the top of the 'sun-melon.' Betty, hold the ball up over your head."

The children did these things and were in this position.



"Now," said Uncle Henry, "I will turn around and round just as the earth does on its axis every day. No matter how I turn, Betty is in line with the sun and with me. If the melon was a bright light like the sun, the light

from it would shine only on the side of the ball away from me, and the side of it toward me would be dark. I couldn't see it at all."

"Do you mean to say," cried Peter, who had left his place in *Mars*' position and come nearer to Uncle Henry, "that the planets aren't like the stars? Don't they shine all the time? Don't they give light themselves?"

"No," said Uncle Henry, "the planets shine only where the sunlight hits them. They are dark bodies like the moon. You remember how the moon was at 'new moon' position? Well, that's the way the Venus-ball in Betty's hand is now. I see only its dark side. Of course if *Venus* should get *right* exactly in line with the sun, as it sometimes does, we could see it as a black dot crossing the face of the sun, but not otherwise."

Then Uncle Henry explained that when the almanac says, "Venus will be in *inferior conjunction*" on a certain day, it simply means that *Venus* will then be in line with the sun and the earth and between them. Sometimes almanacs don't say "conjunction" in words, but use a little mark like this that means conjunction: ⚪

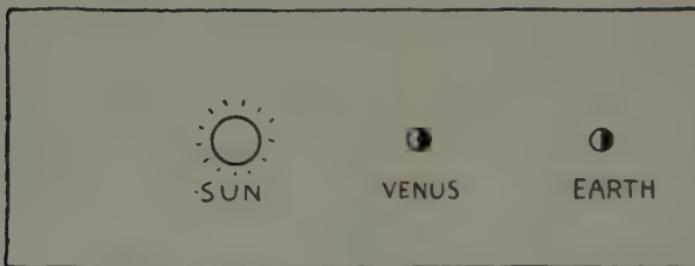
If the almanac says "Venus in *superior conjunction*" it means that Venus will be in line with the earth and sun, but on the opposite or far side of the sun. Here are two little drawings that show the position of *Venus*, the sun, and the earth at both times when they are in line.



Superior Conjunction

Marks in Almanac:

♂ ♀ ☽ *superior*



Inferior Conjunction

Marks in Almanac:

♂ ♀ ☽ *inferior*

"What are those other two little marks, beside the conjunction mark?" asked Betty.

"The first one," said Uncle Henry, "is a crude drawing of *Venus'* hand mirror in which she admires herself. It always stands for *Venus* in almanacs. The other, the circle with a dot in it, always stands for the sun. The three little signs followed by the word 'superior' mean, 'superior conjunction of *Venus* and the sun.'"

When the children understood all about this, Uncle Henry said,

“Now, Betty, while you keep the tapeline from the ‘sun-melon’ tight, move away from me toward the right. Move around the ‘sun-melon’ the opposite way the hands of a watch do. That’s right. Now hold up the ball over your head again and we’ll imagine the melon over there gives bright light like the sun.”

“Oh,” cried Paul, “I begin to see what is going to happen. It’s going to act just the way the moon did.”

“Fine!” said Uncle Henry enthusiastically, “you go on and tell what will happen, Paul.”

“Well,” said Paul, “the ball in Betty’s hand will show Uncle Henry’s ‘Optick Brothers’ more and more of its lighted side as she moves in the Venus-path from the near side to the far side of the sun. When she gets directly opposite to Uncle Henry the Venus-ball will be ‘full’ like the full moon. When she is only a quarter way around, the Venus-ball will be ‘half-full’ and when Betty is just starting away from the part of her path nearest to ‘Uncle Henry Earth’ the ball will show a crescent like the young moon.”

“But why,” called Betty, “can’t we *see* the crescent-Venus and full-Venus the way we do the crescent and full moon?”

“Just because Venus is too far away from our unaided eyes. When you go to the theatre, and sit

away back in the top balcony, you can see the face of an actor, but you need an opera glass to see the expression on his face. Just so you need a small telescope to show the 'phases' or expressions of the face of *Venus*. Here is the way they look through a telescope."

Uncle Henry drew a little book from his pocket and showed the children this picture.



"Is the 'full-Venus' smaller because she is so far away then, on the other side of her path around Old Sol?" asked Peter.

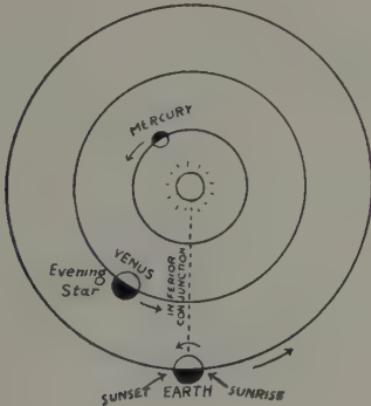
"That's it," answered Uncle Henry, "*Venus* is 134 million miles farther away from the earth when she is full than when her face looks like a little crescent moon."

"I'd like to know," said Paul, "why *Venus* is sometimes the evening star in the West and why she sometimes goes away entirely."

"*Venus* doesn't go away entirely for very long," said Uncle Henry, "only for a few days while she is in line with the earth and the sun—in 'conjunction'

you know. After that you would see *Venus* in the morning sky before sunrise, if you got up early and looked for her. For a long time the ancient people who lived thousands of years ago thought that the 'morning star' and the 'evening star' were two different planets. They named the morning star '*Phosphorus*' and the evening star '*Hesperus*,' but they finally found out that they were both *Venus*. They discovered, you see, that *Venus* simply passed in front of or behind the sun when she stopped being an evening star, and appeared on the other side of the sun as a morning star. These little drawings will help you see how this happens."

Uncle Henry then took out the notebook he always carried in his pocket and made the children these moving pictures, showing how *Venus* is an evening star part of the time and a morning star the other part.

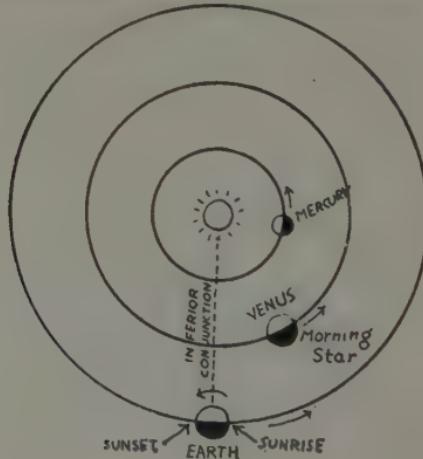


When *Venus* is at the left of the dotted line joining the earth and the sun, she is seen in the West at sunset as an evening star. When approaching "inferior conjunction" she is very bright and shows a crescent through a telescope like this:



Photograph taken by E. E. Barnard, of the Yerkes Observatory, with the Bruce telescope.

But when *Venus* has passed to the right of the line, past "inferior conjunction," she is seen in the East before sunrise as a morning star.



“You see,” said Uncle Henry, “sunrise and sunset aren’t things that happen once every day and then are over and done with. There is both a sunrise and a sunset going on every minute. Sunrise is constantly happening at the line where the surface of the earth comes out of shadow in turning *toward* the sun; and sunset is constantly occurring on the opposite side of the world, where the surface of it is turning *away* from the sun and entering the shadow we call night.”

“Isn’t that wonderful?” cried Paul. “If I was a poet I would write a poem about it.”

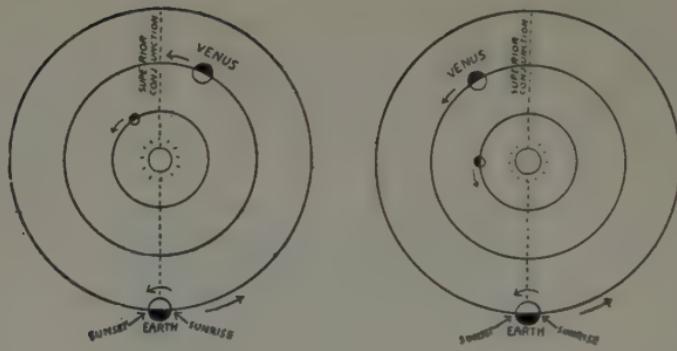
“The right poet could write a good one,” said Uncle Henry. “Well, as I started to say, when Grandfather’s farm gets to the place where it passes out of the sunlit side of the world, around into the shadow side, we see *Venus* in the Western sky, if she happens to be East of the sun.

“*Venus* is also seen as both a morning and evening star when she is in the part of her path that is on the opposite side of the sun. These two little diagrams show how she is a morning star up to the time she passes through ‘superior conjunction,’ behind the sun, and how she becomes an evening star right away afterwards.

“*Venus* isn’t so bright *then*, I suppose?” said Paul.

“Quite right,” Uncle Henry agreed. “Not so bright because she is farther away.”

“Well, what is *Mercury* doing all this time?” asked Peter. “He has a path around the sun too, hasn’t he?”



"Yes," said Uncle Henry, "and *Mercury* becomes a morning and evening star too—much oftener than *Venus* does in fact—for it takes him only 88 days to go completely around the sun, while *Venus* takes 225 days for the trip. You know how long it takes us on the earth."

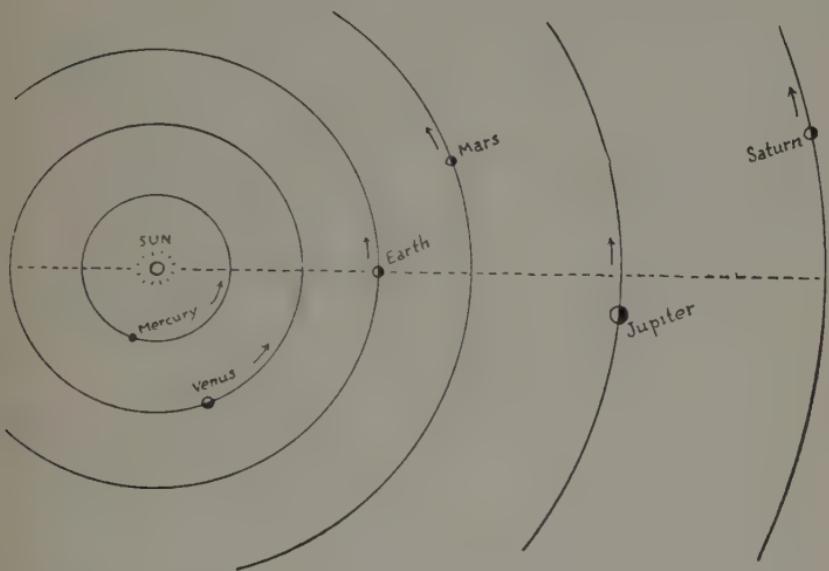
"Three hundred and sixty-five!" the children answered in chorus.

"Three hundred and sixty-five and a quarter, to be exact," said Uncle Henry.

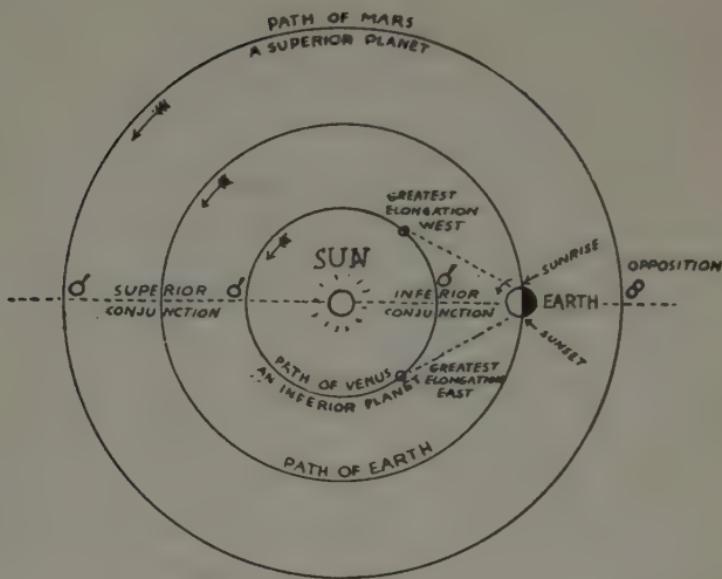
"Now tell us about *Mars*," commanded Peter, "does *Mars* have conjunctions and phases too?"

"No," said Uncle Henry, "not in the same way. *Mars*' path round the sun is outside of ours, and that makes an important difference. *Mercury* and *Venus* are called 'inferior planets' because their paths are inside that of the earth. *Mars* and all the rest of Old Sol's children are called 'superior planets' because their paths are outside of the earth's. A picture will show you the differences at once."

Uncle Henry then made this diagram in his notebook.



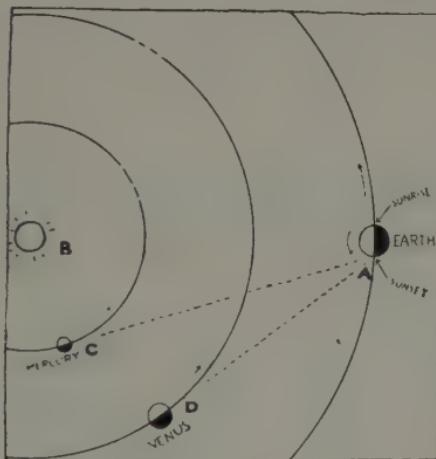
"You can easily see," explained Uncle Henry, "that since the paths of *Mars*, *Jupiter*, and *Saturn* are outside of the earth's, they can never have 'inferior conjunctions' for they never pass between the earth and the sun. When any one of the superior planets, *Mars*, *Jupiter*, *Saturn*, *Uranus*, or *Neptune*, gets in line with the earth on the *same* side of the sun we say it is 'in opposition' to the earth. The mark for 'opposition' in the almanac is like this: 8. This picture will show all these things better than words."



Uncle Henry then showed the children, with the help of this diagram, that *Venus* never gets more than halfway up the sky from the horizon to the overhead point, either as a morning or an evening star. When she is at her highest point in the Eastern morning sky, she is at the position in her path marked "greatest elongation West." In the same way, Venus is at the point in her path marked, "Greatest elongation East" when she is at her highest point in the Western sky, in the evening after sunset. The same things are true of *Mercury*, except that he never gets much over a fifth of the way up the sky from the horizon to the overhead point. This is true because his path is so much smaller than that of *Venus*. An inferior planet is never seen directly

overhead, but the superior planets, *Mars, Jupiter, Saturn*, and so on, can be seen at any height in the sky.

Here are two little pictures that show why *Mercury* is never seen much over one-fifth of the way up the sky, and *Venus* not over half the way up.



If you could look at the sunset sky, when both *Mercury* and *Venus* are at "greatest elongation East," you would see the sun along the line AB, *Mercury* along the line AC, and *Venus* along the line AD. The sky would then look to you like the next picture with *Venus* much over twice as high up as *Mercury*. As a matter of fact, *Mercury* is very hard to see, because he is always so close to the sun that the sunset glow drowns out his light, and when the sun has been down long enough for the sky to get sufficiently dark so we can see *Mercury*, why *Mercury* has just about gone down behind the horizon himself!



When the children said they understood all these actions of Old Sol's children it was already after dinner time, so the meeting adjourned with Uncle Henry's promise to take them all to a "movie-show" in the evening.

"But," said Betty, "there isn't any movie, not unless we go to town, and that's six miles!"

"Uncle Hen means Mr. Puck's movies—on the spider web in the barn," cried Paul. "Thinking of pictures, you know, and watching 'em appear on the spider web screen."

"Oh, goody!" cried Betty, "and I *do* hope Puck'll be there!"

"Me, too!" agreed Paul. "Let's think up some questions this afternoon that we can't answer ourselves, so he'll just *have* to bring the answers."

Then the children decided in favor of dinner, and fishing in the creek afterwards.

SEVENTH REEL

IN WHICH BETTY FINDS OUT HOW MUCH CAN BE TOLD
WITHOUT WORDS—AND WE GET BETTER ACQUAINTED
WITH OLD SOL'S CHILDREN AND GRANDCHILDREN

THE sun wasn't even out of sight when Uncle Henry and the three children met in the barn after supper. Mr. Puck's movies weren't like ordinary ones, so it didn't matter that it wasn't dark yet in the barn.

Peter and Paul put a board across two low saw-horses for the audience to sit on and they were ready to begin. The big spider web screen in the corner behind the feed box was right in front of the audience, ready to begin too.

Betty looked around eagerly for Puck, but he was nowhere to be seen.

Uncle Henry looked quietly at the screen—thinking a picture in his mind, and in a moment it began to appear dimly on the dusty, spider-woven screen.

The picture was such a queer shape that none of the children could make it out at all. It was a funny-looking symbol or emblem like this:



While the children were wondering what it could possibly be the symbol began to change. Heads appeared on the ends of the curved lines and a stick appeared between them. Finally they became snakes, like this:



"Oh," cried Paul, "I've seen something like that before. Why, it was on the uniform Uncle Henry wore during the war."

"Yes," said Peter, "and Uncle Henry was in the Medical Corps. That thing means that the soldier who wears it is in the Medical Service."

"Quite right," said Uncle Henry, "it is used as a doctor's emblem everywhere, and has been for a long time. Now see if you can tell who owned the emblem of physicians among the ancient people."

Then the rod with the snakes began to get smaller and smaller on the spider web screen, and a figure of a man began to appear. When he had become really clear he had the stick with the snakes in his hand, and the children saw that he had wings on his feet and on his cap, like this:



"Why, that's the flying *Mercury* we have on the hall table at home!" exclaimed Paul.

"Yes," said Uncle Henry, "and if you look in the almanac you will find that the little symbol we saw first is always used to stand for *Mercury*, the planet. The little mark is still called by its Latin name, which is '*caduceus*.'"

"What is the mark that stands for beautiful *Venus*, Uncle Henry?" asked Betty.

"What is it that every woman likes to use if she is beautiful?" asked Uncle Henry in return.

"A mirror!" exclaimed Betty promptly.

"Righto!" laughed Uncle Henry, "well, watch the screen for it."

The children all watched, and in a moment this little drawing appeared.



"Is that *Venus'* emblem in the almanac?" asked Paul.

"Yes," said Uncle Henry. "Watch the screen again and you'll see how easy it is to turn our symbol of Venus into her mirror and back again."

The children did, while the mirror-symbol turned into a real hand mirror, like this:



Then the mirror got smaller, while a woman's figure slowly appeared. When she was clear she was the Venus de Milo, with a mirror in her hand.

That's how she looked before she lost her arm,"

said Uncle Henry. "At least, that is how some people think she looked."

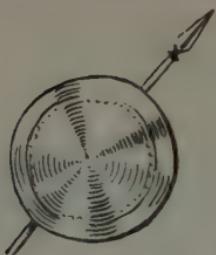


"*Mars* is next!" cried Peter.

The *Venus* was already fading out on the screen and when it had entirely gone another almanac symbol began to appear. It looked like this:



Then, as before, the outlines slowly dissolved and the picture gradually changed into a picture of a shield and a spear, like this:

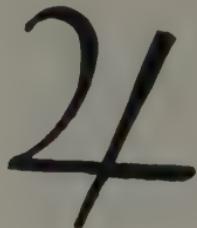


"*Mars* was the God of War, wasn't he?" asked Betty.

"Sure," said Peter, "anybody knows that! Look at his shield and spear."

"Well, I think he's horrid! I don't want to see him. I'm going to shut my eyes if he appears."

Uncle Henry said nothing, but kept on thinking pictures, and in a moment a very strange-looking symbol appeared on the spider web in place of *Mars'* shield and spear. It was sort of a figure 4, like this:



What could it be? The children were puzzled until the figure 4 began gradually to take the shape of a bird. In a moment more it had turned into an eagle, with his beak toward the left, like this:



"The eagle," said Uncle Henry, "was the particular favorite of *Jupiter*, the chief of the Greek Gods, so the almanac uses the symbol of the eagle to stand for *Jupiter* himself. The King of Birds for the King of Gods, you see."

Then the eagle faded from the cobweb screen, and as soon as it was gone the next picture that Uncle Henry was thinking about started to appear. It was just as queer a shape as the figure 4 had been, and looked like this:



"It would almost be a question mark if there was a dot under it," said Peter.

"Oh, look!" cried Paul, "what it's turning into."

As the symbol faded out and the object it stood for faded in, the children recognized it just as quickly as you will.



"It's a sickle!" exclaimed Betty. "Why is it a sickle, Uncle Henry?"

"Because it stands for *Saturn*," answered Uncle Henry, "and *Saturn* was the God of the Harvest among the ancient people who named the planet for him."

"What comes next, Uncle Hen?" asked Peter.

"There are two more planets," said Uncle Henry, "and their names are *Uranus* and *Neptune*, but they are so far away and we know so little about them that if you don't mind we won't bother with them at all."

The children agreed to pass over *Uranus* and *Neptune*, just as we often pass over our very distant relatives at Christmas time.

"These five planets," said Uncle Henry, "*Mercury*, *Venus*, *Mars*, *Jupiter*, and *Saturn*, have been known and watched by people for thousands of years. It was because they moved slowly about among the other stars that people named them 'planets,' which simply means 'wanderers.' After awhile, people noticed that the planets did not move haphazard among the other stars but all followed the same path, which was named the 'zodiac.'

"It is the same path the sun takes in the daytime, so you know right away that you will never see any of the planets in a part of the sky where you have never seen the sun."

"Can't we see some 'close-ups' of Old Sol's family to-night, Uncle Hen?" asked Paul. "You know—big pictures like the faces on the movie screen when the villain glares at the heroine."

"Oh, yes," pleaded Betty, "let's see the canals on *Mars*, an' everything."

Uncle Henry looked doubtful and shook his head.

"I've seen such pictures, Betty," he said, "but I hardly believe I remember them plainly enough to *think* them onto the spider web across so you can see them."

"Oh," cried Paul suddenly, "look! Look at the web!"

Everybody turned to look, and were astonished to see a picture forming slowly on the spider web screen.

"Oh, I know!" cried Betty, "it's Mr. Puck doing it. He's coming to help us out. It's Puck who is thinking the picture."

And so it was, for in a moment the children heard his squirrel-like laugh and there Puck sat on top of the feed box, with his long, green legs curled up under him. One moment he wasn't there at all, and next moment he was. It was astonishing the way Puck came and went, without a second's warning—just the way you think of things and forget them.

Meanwhile the picture on the spider web was

getting plainer. It was a globe, turning slowly round upon its axis, and at the north pole of it was a white spot, like this:



Photograph from Yerkes Observatory.

"It looks like the world, with all the white snow and ice at the north pole," said Paul.

"It is a world," said Uncle Henry, "but not ours. It is our little brother *Mars*, and the white cap on his head is just what you thought—a field of frozen ice and snow around the north pole. We know this because when it is Summer on *Mars* the white snow-cap melts and melts and gets smaller and smaller until it entirely disappears. It takes a telescope

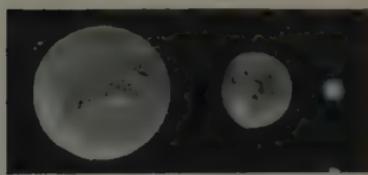
at least three inches in diameter to enable you to see the polar cap on *Mars*."

Here Mr. Puck picked up a long straw from the top of the feed box and waved it across the picture like a wand. At once the white cap at the pole of *Mars* began to shrink, and get smaller and smaller until it was all gone. This moving picture shows how it happened. On *Mars* Summer is six months long, because his year is twice as long as ours.

"Sometimes," said Uncle Henry, "*Mars* is too far away to see the polar caps well, even in a powerful telescope. This is when he is on the opposite side of his path from us, near the 'superior conjunction' position we learned about. It is when *Mars* is on the same side of the sun with us that he is biggest and plainest. That is the time astronomers study the polar caps and try to see whether he really has canals or not."

This little picture on the next page shows the different sizes *Mars* appears to be when nearest, farthest away, and halfway between.





"Do *Mercury* and *Venus* wear 'polar caps' too?" asked Betty.

"No," said Uncle Henry, "there is very little to see through a telescope on either *Mercury* or *Venus*. Their changes in 'phase,' from full to crescent and back again are the main things about them."

Puck waved his wand of straw across the picture on the screen and it vanished. In its place a great globe appeared with broad stripes across it, like this:



"Now," said Uncle Henry, "you will see some of Old Sol's grandchildren. Does anybody find them in the picture?"

"I do," said Paul, "aren't those four little round dots the babies of the big round globe?"

"Yes," replied Uncle Henry, "and the big round globe is *Jupiter*, the biggest of all Old Sol's family. *Jupiter* has four little children, or moons, that can be seen easily even in a very good field glass. There are others besides, but they are so tiny it takes a

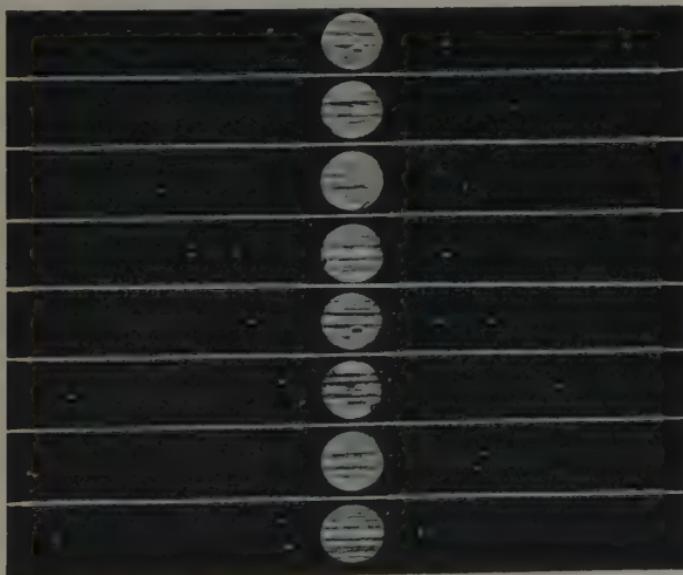
very big telescope to see them. It takes a three-inch telescope to see the belts of cloud that *Jupiter* always wears around his middle."

"Do *Jupiter's* children all have paths around him too—the way we, and *Mars*, and *Venus* have paths around our father, Old Sol?"

"Yes, that's right," agreed Uncle Henry, "and so we cannot always see four of them at once. Sometimes they get behind *Jupiter* and go out of sight."

Mr. Puck waved his straw wand over the screen again, and the moons of *Jupiter* began moving back and forth across the round globe. They were really going round and round *Jupiter* but they seemed just to swing back and forth like pendulums.

This is the moving Picture Mr. Puck made the children see on the cobweb screen:



"Did you ever hear of *Galileo*?" asked Uncle Henry.

The children had heard of him but didn't know anything about him.

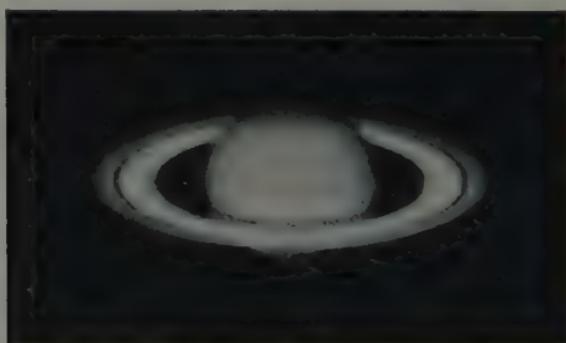
"Old One," cried Puck suddenly to Uncle Henry, "I knew *Galileo* well. He kept me busy all his life—fetching him answers. He wished to find out everything, especially about the stars. I well remember the night he pointed the new telescope he had just invented at *Jupiter*. He gave a cry of joy and sat up all night, looking through the telescope, for he had seen what no living man had even seen before him—the moons of *Jupiter*."

Puck waved the straw wand once more. The little moon-children of *Jupiter* the giant planet, faded out, and finally belted *Jupiter* himself was gone.

The picture that came in his place had hardly become clear before Peter and Paul cried, both together,

"That's *Saturn*, and his rings!"

Saturn appeared like this on the spider's movie screen.



Photograph taken by Mr. E. E. Barnard, of the Yerkes Observatory, with the 60 inch reflecting telescope at Mount Wilson Observatory in California.

"Has *Saturn* any children, Uncle Hen?" asked Peter.

"Only eight!" smiled Uncle Henry, "—but they are all very small. Mr. Puck, will you please show us how *Saturn* and his eight children would look in a big telescope."

Puck again waved his wand of straw across the spider web and this picture slowly appeared.



"Are we going to see a movie of *Saturn's* moon-children going around him in circles too?" asked Betty eagerly.

"It would be just about like the movie of *Jupiter*," said Uncle Henry. "Shall we show it to them, Mr. Puck—or make them imagine it for themselves?"

"Locked doors need keys but once, Old One," said Mr. Puck mysteriously.

The children didn't know what he meant until the next picture had become clear on the screen. It was a picture of Betty herself.

Then Paul appeared, walking round her in a circle. In his hand he held a big humming top, like this:



Paul held the humming top so that its handle, or axis, slanted just about the same as the axis of the geography globe does.

As he walked around Betty in a circle, the moving picture of Paul on the screen kept the handle of the humming top always slanted in the same direction.



When the Betty in the picture looked at the humming top in this position, the axis, or handle, was tipped toward her, and she could see the upper side of the top, like this:



But when Paul had walked a quarter way round the circle into this position—



—the top looked like this from Betty's place at the center of the circle:



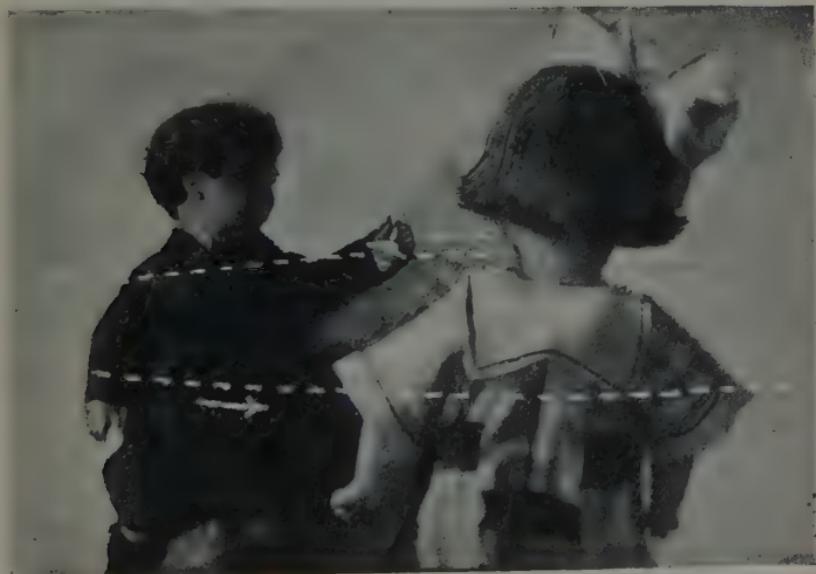
Then the Paul in the picture went a quarter of the way farther round so that the top was in this position—



—and the Betty in the picture could see the bottom side of the humming top, like this:



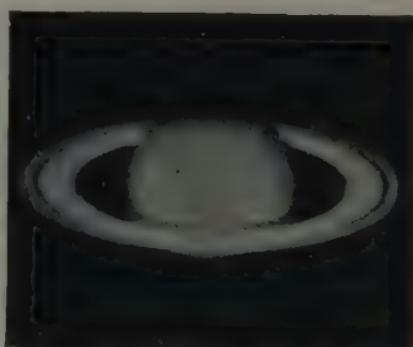
When the Paul in the moving picture had walked three-quarters of the way round the circle, still holding the handle of the top slanting in the same direction, the two picture-children and the top looked like this—



—and Betty in the picture again saw the edge of the humming top as a straight line, without seeing any more of the upper part of the top than she did of its bottom part.

When the Paul in the picture had walked the rest of the way round his path, the humming top looked just the same to Betty in the picture as it did when Paul started to carry it around her.

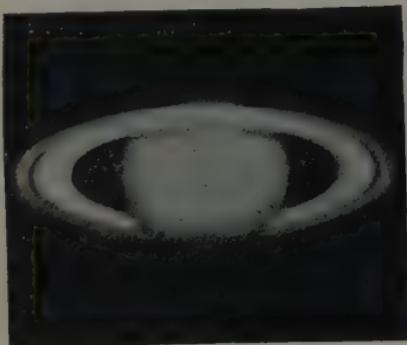
“Now you know,” said Uncle Henry, “how the rings of *Saturn* change their appearance to people on our earth while *Saturn* is traveling in his path around the sun. It takes him twenty-nine and one-half years to do it, so when we look through a telescope, and see *Saturn* looking as the humming top did in the first picture—



—we know that in about seven years, when *Saturn* is a quarter way round his path, he will look as the humming top did in the second picture.



“Then in about seven years more we can expect *Saturn* to look as the humming top did when Betty could see the underside of it.



“Then, of course, in about seven years more, *Saturn* will again show us only the edge of his rings, and when he has completed his journey round the sun the upper side of the rings will again be visible, as they were when his trip started.”

Here is a moving picture of the way *Saturn* looks from the earth through one whole trip around the sun. The dates beside the pictures show how he will look for quite a long time to come too.

“So that’s all of Old Sol’s family we are going to see?” asked Paul, as the last picture faded from the spider web and the children noticed that the barn was almost dark.



1921

1922

1924

1926

1928

1930

1932

1934

1936

"There is very little known about *Uranus* and *Neptune*, our most distant relatives," said Uncle Henry, "and nothing as interesting to see as the white cap *Mars* wears.

"Mr. Puck," he asked of the little green man, "have you any more moving pictures on the program of this theatre to-night?"

There was no answer, and when the children and Uncle Henry peered through the dusk there was no Mr. Puck to be seen.

Just then, however, Betty noticed a faint glow on the spider web, and as it grew in brightness the audience read these words, Puck's parting message,

"When I undertake to tell the best I find I cannot, . . . I become a dumb man." *

* Walt Whitman: "A Song of the Rolling Earth."

The children were quiet a moment or two, wondering just what the words on the spider web meant.

Then Betty said, "Those words on the screen don't mean that we have to answer all our own questions after this, do they, Uncle Henry? Can't we ask Mr. Puck any more? Why, we'll *never* get over wanting to ask Mr. Puck for answers about the stars, and the earth, and its flowers, and clouds, and trees, and birds, and animals and—and—and—everything—at least not until we're quite grown up!"

"I hope not even then," said Uncle Henry quietly. "Mr. Puck just means that he cannot tell you the most wonderful answers in the world until you are a little older and begin to wonder what they are."

In a moment the picture of the Fairy Ring gradually appeared on the screen.



"Oh, I see," said Betty, "we must wonder and wonder—about bigger and bigger things—Puck will bring answers only to those who are in Wonder Rings."

Uncle Henry nodded his head and smiled, and the Fairy Ring faded from the spider's movie screen.

